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VETERINARY MEDICINE SERIES
No. 16
Edited by D. M. CAMPBELL

BOVINE TUBERCULOSIS

By

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With an Introductory Article by

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A Discussion of the Intradermal Tuberculin Test by

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STATE VETERINARIAN OF MISSOURI

And an Article on the State Accredited Herd by

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FORMER STATE VETERINARIAN OF ILLINOIS

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FOREWORD

The control of tuberculosis in man is everywhere recognized as primarily a problem of education; the control of bovine tuberculosis has been considered to a great extent a matter of police regulation. While drastic police regulations are doubtless more effective in detecting the presence of bovine tuberculosis, and preventing its introduction to new fields, than in accomplishing the same ends in tuberculosis of man, such regulations cannot prevent the extension of this disease among animals closely associated to the extent that its spread among closely associated persons can be prevented. The further facts that it is not practical to treat the diseased animal, and that tuberculosis may be eliminated from an affected herd by the slaughter of infected animals, make the control of bovine tuberculosis essentially a different problem from the handling of tuberculosis in man. Still, we believe the handling of bovine tuberculosis is, primarily, no less a matter of education. The owner of the diseased animal and the owner of the herd that is clean, both must be made to understand the cost, and the danger of this widespread disease. The municipal, state and national sanitary officials charged with the control of animal diseases and the inspection of animal food products, must understand the stockmen's problems. They must know the value of animals, not only their value *per se*, but their value as a part of a going business. They must appreciate the value of blood strains and the loss entailed from interference with an established enterprise. The consuming public must be educated to appreciate the cost of dairy and meat products produced under sanitary conditions by healthy animals and, most of all, the practicing veterinarian upon whom ultimately depends the control and eradication of infectious diseases of animals, must be awakened to his responsibility in the matter of bovine tuberculosis and to a full realization of the problems of the owner of the diseased animal, of the sanitary police, and of the public. He must realize with a vividness that it can never escape him, that he owes no higher duty to his patrons, to the state and national officials under whose direction he must work, to the public and to himself, than to give the best that is in him in conscientious, careful, dependable work when called upon, as he must be to assist in the control of this scourge of the live stock industry.

It is in the hope that this little volume may serve this educational purpose better than any existing publication, that its preparation has been undertaken. The entire discussion has been couched as far as possible in plain language understandable by all interested. Each subject has been presented by one, not only experienced, but recognized as an authority in that particular phase of this subject.

D. M. C.

CHICAGO, August, 1917.

CONTENTS

PAGE
INTRODUCTION, by E. Z. Russell.................. 7

I

BOVINE TUBERCULOSIS, by J. F. DeVine.......... 31

II

THE INTRADERMAL TEST, by D. F. Luckey........ 79

III

THE STATE ACCREDITED HERD, by O. E. Dyson.... 101
INDEX 119

INTRODUCTION

By E. Z. RUSSELL

The loss to farmers and stock growers on account of bovine tuberculosis existing in both cattle and hogs, is something that is by no means receiving the attention it should from live-stock men.

During the time that foot-and-mouth disease was present in the United States, in 1914, 1915 and 1916, every stock grower in the country was more or less alarmed, daily watching the papers to see if any new territory was afflicted.

The secretary of agriculture, in his annual report, summed up the loss to the live stock industry from foot-and-mouth disease during the time it was in the country as totaling about $9,000,000. Truly, an enormous sum! Yet the same authority says that the best figures obtainable show that our live-stock men are annually suffering a loss of $25,000,000 and have been suffering such a loss for many years past, on account of bovine tuberculosis.

This is not all. We will continue to suffer this loss, and probably a greater loss, until such time as our live-stock producers wake up to the fact that they are sustaining this loss and start the movement for its eradication by every man taking such steps as are necessary to wipe it out of his own herd, instead of ignoring the matter entirely or trying to cover up facts.

With the facts of this enormous loss staring us in the face, can we afford to ignore the existence of the disease? Can any farmer or live-stock producer, for the safety of his family and for financial good, afford to delay longer ascertaining whether or not tuberculosis exists on his farm?

How many men seriously consider what may be the results of trying to cover up the existence of the disease among their animals and what the consequences may be if they sell a diseased cow to someone who may use the milk for family purposes, particularly to feed it to a baby?

I have made this statement that the animal losses on account of bovine tuberculosis to the live-stock producers of the United States, according to data in the hands of the secretary of agriculture, amounted to $25,000,000 annually. Undoubtedly many will wonder how this loss is occasioned and who shoulders it.

First, the loss is sustained because of the number of cattle and hogs that are condemned by government inspectors at the various packing plants where government inspection is carried on. The carcasses are ''tanked''; that is, they are destroyed and used only for fertilizer. This inspection by government officials is carried on at all packing plants where any of the product is shipped out of the state in which it is killed and packed.

Inspection of all animals is made on foot, by competent men. Quite a number of diseased animals are weeded out in this manner. After slaughter the carcasses are thoroughly examined and disposition made of them according to the conditions found by the inspectors. Thousands of carcasses are condemned in this manner.

In addition to the whole carcasses of animals being condemned, oftentimes a part of the carcass is condemned for food and passed for grease or for sterilization, thereby making a partial loss. The loss in this manner amounts to considerable.

At this time I want to call attention to one fact in connection with the matter of meat inspection. We refer to the meat consumed in the United States that is not inspected. The Bureau of Animal Industry of the United States Department of Agriculture estimates that from fifty-eight to sixty per cent of the meat used in the United States is inspected by inspectors in the employ of the bureau. This means that from forty to forty-two per cent of the meat consumed does not pass under the eye of the federal inspector.

During the fiscal year ending June 30, 1915, some 58,000,000 animals were inspected by federal inspectors, which means that some 40,000,000 carcasses were consumed in the United States in that one year that did not have the inspection of the Bureau of Animal Industry. A small percentage of these 40,000,000 carcasses were given a real inspection by municipal inspectors in cities were an honest effort is made to carry out the provisions of the ordinances of these cities.

There is a larger percentage of these 40,000,000 carcasses that are supposed to be inspected under the provisions of a city ordinance requiring an inspection, but where the office of city meat inspector is filled in order to pay a political debt, the ordinance is nothing more nor less than a joke. Then there is a much larger percentage of these carcasses of which there is not even a pretense made at inspection, no ordinance or regulation of any kind pertaining to inspection of meat being in existence in many cities.

Perhaps the question arises as to how one may be able to protect himself against buying and eating diseased meat. There is but one way—buy only meat that has been inspected at the time of slaughter by an inspector competent to do his work, and not only competent, but working under an ordinance providing for rigid inspection and under city officials determined to carry out the provisions of the ordinance, or buy meat that has been slaughtered in a plant at which Bureau of Animal Industry inspection is maintained. An inspection of dressed carcasses or parts amounts to little more than a search for putrefied meat. It seldom can be a means of detecting disease.

I have studied Bureau of Animal Industry inspection and watched plants in different parts of the United States and feel perfectly safe in saying that any part of a carcass that passes a federal inspector and receives his O. K. is perfectly fit for food at that time. Bureau of Animal Industry inspectors as a whole are men of high type, of integrity, trained in a particular line, under no detrimental influences whatever. They know that their future with the department depends on satisfactory services rendered. Officials of the Bureau have proved themselves worthy in long years of service. They have many serious problems to handle, and are quite severely criticised by some individuals, but the record of success stands to refute any charges of fraud or incompetency that may be made.

There is the further loss to the grower on account of the affected animal failing to make the gains it should make for food consumed. No seriously diseased animal can make satisfactory gains, and its being kept in the herd is a source of indirect loss.

Some producers in the case of valuable breeding animals keep such as are diseased separate from the rest of the herd in quarantine, entailing the expense of extra work in feeding, raising the calves by hand, pasteurizing the milk, etc. If this is followed to any great extent the total loss foots up to a considerable amount.

It has been demonstrated that often a cow affected with tuberculosis will not breed. In a case of this kind there is a considerable loss.

Who shoulders this loss? Literally speaking, I don't know. Every packing plant in the United States knows exactly how many animals are condemned in the plant each day, how many parts, and their value. It is useless for us to say that the packers suffer this loss, for they don't.

The packers, in computing the daily losses, know just how many cents per hundred pounds they lose and I presume can charge this back to the producer in the way of a reduced price per hundred pounds on all animals purchased, or they can add a certain percentage to the selling price of their meat to cover the loss, or they can resort to both methods for reimbursement for condemned animals. They can follow either one or both of these methods.

Whether or not the packer is able to charge this loss to one or the other or to both of these different sources, I know that the packers of the country would far prefer buying only animals free from disease. The necessity of keeping account of these condemned animals is a source of expense and trouble to them and these interests stand ready to assist in any manner they can to wipe out tuberculosis from among the cattle and hogs of the country.

There is no doubt in my mind but that a certain percentage of this loss is charged back to the producer in a reduced price paid by the packer. In this case who pays? The answer is: Every man who sells cattle or hogs for meat. Under the present system of marketing it is impossible for the packer to know from whence or whom he purchases a very large percentage of the condemned animals. A small percentage are bought subject to post-mortem inspection, and the loss can be and is charged back to the seller.

It will at once be seen that the man who raises and sells animals free from disease suffers the loss and helps to pay just the same as does the man who maintains a herd affected with disease. Is this fair?

Packers are locating, whenever possible, localities or shipping points from which large numbers of diseased animals come and refusing to buy animals from these points unless they can get them at a reduced price or "subject." There are in the aggregate, however, few of these centers known to the packers.

I recently asked a hog buyer at one of the eastern Nebraska towns if he ever got any tuberculous animals. He replied that he did; that about three years before he sent in a carload of hogs to South Omaha that sold to one of the big packing concerns at a top price. This load showed a big percentage of tuberculous animals, and, not being sold "subject." it was the packer's loss. The buyer told me that he had been unable to get this packing firm to bid on a load of hogs since. In this case at least one firm was eliminated from competition in the selling of the hogs from that particular point. Every farmer selling from that point suffered in consequence.

What about the consumer? Does he have to bear any part of this burden? He certainly does. For the sake of argument, I will grant that the packer charges back to the producer, in the way of a reduced purchase price, the whole of his losses through condemnations, and does not reimburse himself by way of an added price to the consumer. Wherein, then, is the consumer having any of the burden? If this annual loss of $25,000,000 could be wiped out, or if a major portion of it could be saved, would not the increased production of that amount of good, clean meat have something to do with the price? I believe it would.

The consumer of both meat and milk and their various products is, or should be, mightily interested in the question of bovine tuberculosis and its eradication. We refer here in particular to the city dweller, the one who is all the time on the buying side. There can be no question but that he will be greatly benefited by the eradication of bovine tuberculosis.

One of the interesting facts brought out by my investigations was that tuberculosis among cattle and hogs is not confined to any particular locality, state or part of the country. We have found that, in a general way, the disease exists to a greater extent in some parts of the country than in others, yet where the general average is not so large we have found particular herds where the disease has affected a large percentage of the animals.

To indicate, in a general way, the prevalence of tuberculosis throughout the country, I submit herewith percentages given us by Dr. A. D. Melvin, chief of the Bureau of Animal Industry, for the fiscal year of 1915, at establishments where federal meat inspection is maintained:

Section of Country	Percentage of Cattle Affected	Percentage of Swine Affected
Pacific coast	1.64	10.2
Southwest	.081	1.59
Missouri valley	1.37	5.63
Mississippi valley	3.22	10.18
Entire country	2.27	7.66

It will be seen by the above figures that the largest percentage of diseased cattle is in the Mississippi valley country. My explanation of this is that this part of the United States contains more dairy and pure-bred beef cattle than does any other part of the country.

My investigations have shown that there is a much larger percentage of tuberculosis among dairy and pure-bred beef cattle than among any other kind of cattle. This is probably due to two reasons. Dairy and pure-bred beef cattle are kept housed much more than range or common grade cattle, thus there is greater opportunity for the extension of the disease among the individuals of a herd, and there is greater traffic in them, thus greater opportunity for the dissemination of the disease from diseased to healthy herds.

It may be the opinion of some that range cattle that are never housed, and whose ancestors have not been housed for several generations, do not have tuberculosis. This is untrue. I have found several instances where range cattle are quite badly affected. In southern California in 1910, Dr. A. R. Ward tested about 1,000 head of range cattle and found about ten per cent reactors. However, range cattle are not as susceptible to the disease as are the dairy and pure-bred beef cattle.

This can be explained by the fact that, in addition to housing, dairy and pure-bred beef animals change ownership more often than do range or common grade cattle. If any of these animals change owners, and are diseased going into a clean herd, they are the means of starting an infection in a new place.

At El Paso, Texas, where the cattle are in the open nearly all the time, the city veterinarian reports the first tuberculin test of herds supplying milk to the city as showing ten per cent of reactors, and subsequent tests as showing from two per cent to five per cent of reactors. Some herds showed eighteen to twenty per cent.

A very interesting report comes from Dr. W. J. Butler, state veterinarian of Montana. In 1911 he tested 7,799 cattle and found 829 reactors, or 10.63 per cent; in 1912 out of 7,150 tested, there were 481 reactors, a percentage of 6.7; in 1913 a test was made on 5,788 cattle; there were 174 reactors, or .03 per cent.

According to the 1915 reports of the chief of the Bureau of Animal Industry, there were inspected on foot at the different market centers in the United States by bureau inspectors 6,965,415 cattle and 36,247,958 head of hogs. Of these animals there were condemned for tuberculosis 32,644 whole carcasses of cattle and 48,401 parts of carcasses on post-mortem examination. There were also condemned 66,023 whole carcasses of hogs and 439,915 parts of carcasses.

Some figures showing exactly the number of hogs retained at the plants of one of the packing companies by Bureau of Animal Industry inspectors for the year ending October 30, 1915, will be instructive. They follow:

HOGS

	Total	Tuberculosis	Cholera
Chicago	15,083	12,096	2,373
Kansas City	3,081	1,030	1,548
Omaha	7,432	2,982	3,292
Sioux City	10,455	6,506	2,796
St. Louis	3,914	2,388	1,290
Fort Worth	514	126	229
St. Joseph	3,156	748	1,318
Fowler, Ind.	4,676	927	2,630
Denver	797	229	120
Jersey City	127	84	28

Below is given some totals showing the number of cattle retained for all causes by Bureau of Animal Industry inspectors at different points for nine months ending July 10, 1915, and also the number retained for tuberculosis at these different points:

CATTLE

	Total	Tuberculosis
Chicago	2,961	2,712
Kansas City, Mo	392	206
Omaha	482	350
Sioux City, Ia	992	808
St. Louis, Mo	604	115
Fort Worth, Tex	593	20

These figures on cattle are taken from one of the large packing concerns of the country and the figures on hogs from another. The percentages of the retained animals shown in the two statements will practically hold good with all packing plants; that is, those under Bureau of Animal Industry inspection. Animals slaughtered in slaughter houses or packing plants not under Bureau of Animal Industry inspection cannot, of course, be included in any figures that may be given. It is certainly fair to presume that as large a percentage of diseased animals go to these non-inspected plants as do to those under inspection. Possibly, and probably, more carcasses that should be condemned go through non-inspected plants.

It will be seen from the foregoing figures that from all hog carcasses retained at the different points 55.07 per cent were retained on account of tuberculosis and 31.72 per cent on account of hog cholera; also, of all cattle retained for all purposes 70.56 per cent were retained for tuberculosis.

Naturally, when any disease gets as much of a foothold as this disease has in our live-stock and in man, eradication is not an easy problem. Possibly we should first consider control with a view to eradication. However, eradication is the end at which we must aim and the result that must be brought about as rapidly as possible for both economic and health reasons.

In talking with one of the most prominent veterinarians in the United States and one who has given a great deal of study to the question, he made the remark to me that eradication of tuberculosis was ninety per cent educational and made the further statement that this applied to the producer of live-stock, the consumer of animal products and the officials who must necessarily be in charge of the work. Undoubtedly this statement is a little extravagant, yet I am convinced that it is largely true.

I believe that one of the main avenues through which effective work will be done is that of the various city and village boards of health, this through the enactment and enforcing of ordinances prohibiting any milk being consumed or sold within such city or village except from cows that have successfully passed the tuberculin test. Necessarily, if this work becomes effective there will have to be competent men to apply these tests. The one great trouble at the present time with effective work in this line is that far too many health officials are controlled by politics, and men having this work in charge in a certain city or village this year may, on account of the expiration of a political term, be removed from office and have nothing to do with the work during the year following. In our opinion, health officials should be under civil service regulations; that is, they should retain their positions just as long as their work is satisfactory.

In conducting my investigations in this matter, I found in one city the health officer had been in charge of that work for twenty-eight years. Naturally, that man was doing far more effective work because of his years of experience and contact with different people, both official and others, with whom he has to deal than if he had but recently been in charge of the office.

Health officials of a city should be men of unquestioned integrity, men who will dare to do what is right regardless of adverse criticism. This class of men is not always found on health boards, yet it is entirely possible that such may be placed in these official capacities if an honest effort is made.

That cities and villages have the authority by law to pass ordinances requiring these tests to be made is no longer doubtful. The first and only case I know of that has gone to the supreme court of the United States was that of the city of Milwaukee, Wisconsin. This city in 1908 passed an ordinance requiring the tuberculin test of herds supplying milk for sale in the city. In attempting to enforce this ordinance the officials ran against very serious objections from the milk producers. Attorneys were hired and the ordinance fought in every court to the supreme court of the United States. That court in 1912, or four years after the passage of the ordinance, declared it valid. After that preparation was made by the city officials for its enforcement. Unfortunately, in the promulgation of the ordinance and calling for its enforcement, the officials, in addition to the inspection of the cattle, required certain sanitary conditions to be complied with which required some outlay of money on the part of almost all producers, and said: ''The compliance with this ordinance shall in no wise affect the retail price of milk in the city of Milwaukee.'' Here a serious mistake was made.

It was stated to me by men who have gone all through the fight in Milwaukee that had the city officials allowed the milk producers supplying milk for that city to advance the price of milk ten cents per can of thirty-two quarts, or less than one-third of a cent per quart, the city of Milwaukee would have been on a test basis two or three years ago. Milwaukee is not yet on a test basis, but probably will be within the next twelve to eighteen months. City officials are coöperating with the milk producers, and the results are quite satisfactory.

There are surely two sides to this question. If milk producers are required to comply with these various sanitary conditions, to go to the expense of having their cows annually or sometimes semi-annually tuberculin tested, and we feel sure they should be, is not this milk worth more to the consumers than if it was sent to them under the old style insanitary conditions and drawn from cows of which no knowledge was had as to their physical condition? In my opinion, the consumer should pay more money for this kind of product, and I further believe that more than ninety per cent of the milk consumers would gladly pay a small additional price for milk that would come to them under these conditions. It certainly is not fair to require the producer to stand all this additional cost when the consumer is the one most benefited.

Some officials have claimed that it is absolutely impossible for them to enforce an ordinance of this kind. This has proved not to be the case, for several of our good-sized cities throughout different parts of the United States now have these ordinances and have them enforced as far as it is practical, and results obtained are entirely satisfactory to the officials and I can truthfully say that, although some producers object strenuously to complying with these ordinances, they are generally more than satisfied after they have been compelled to comply with them for a year or more. In complying with these ordinances the producer protects himself from the possibilities of diseased animals; he also protects himself from the ravages of the disease among his cows, the loss occasioned by decreased production and oftentimes by sterility, as it has been conclusively shown that cows having tuberculosis often will not breed.

The city officials who think an ordinance of this kind cannot be enforced are generally those who have never tried to enforce it. An ordinance of this kind is not unreasonable; consequently it is not unworkable. It only requires a united effort, and if the public is to be protected as it should be, this united effort must be made.

The extent to which the hogs of the United States are affected by this disease is by no means realized by the average hog grower. That we may be more familiar with the facts and begin to wake up to its importance, I want to quote what the Bureau of Animal Industry says about its prevalence.

In the report covering all the hogs slaughtered in all plants in the United States in 1916 the department says that nine per cent were diseased to a greater or less extent.

I stated that there were actual condemnations, animal carcasses thrown in the tank by the government officials, enough to cause a loss of at least 10 cents per hundred pounds to the packers for all hogs they buy. Who stands this loss? We know the packers are not standing it, and no fair-minded man would ask for a minute that they do stand it. Wouldn't it be good business for us to realize this fact and give some time and attention to this matter? Wouldn't it be good business for us to go at it and give our assistance to those trying to stop this loss and quit calling them cranks, fools and grafters?

What, then, can we and should we do to help? First, every farmer should have all the cattle he is keeping on the farm for breeding purposes tested by a man who is thoroughly reliable and competent to do the work. Send to the slaughter every reacting cow or bull; this for the reason that the disease in hogs comes from following cattle affected with tuberculosis or from drinking unpasteurized milk from diseased cows.

Everything in the hog line not valuable as breeding animals should likewise be slaughtered. In the case of pure-bred hogs the valuable breeding animals should be tested and every reactor slaughtered. After every diseased animal is off the premises, a thorough disinfection must take place.

Some few years ago a hog breeder friend of mine had some trouble with his hogs. He didn't know what was the matter. A shipment of a carload to market revealed the fact that tuberculosis was in the herd to a serious extent; so extensive was the disease on this farm that every hog was sold, a thorough disinfection given and a new start made in the business.

I don't want to unnecessarily alarm live-stock owners, but I do want to make plain the fact that tuberculosis does exist among hogs. Don't put off the day, but get at it at once if anything wrong is noticeable among them or if you find any diseased cattle that have been followed by the hogs, or if the milk from them has been fed to hogs.

In most states at least it would be impossible to convince the legislatures that this is a problem in which the whole people are interested, and that because of this a sufficient appropriation should be made that cattle owners may be remunerated for diseased animals found and slaughtered by state authorities. It is absolutely certain that cattle owners will object most strenuously to having their animals slaughtered without remuneration, and justly so, and for this reason it would be necessary that money for this purpose be appropriated.

As previously explained, the consumer, the city man who is not an owner of cattle or a producer, is concerned in the eradication of this disease. The producer is also a consumer and therefore doubly interested in the eradication of tuberculosis. In consequence of this, it is our opinion that there should be raised a fund for remuneration purposes, part of which should come direct from the cattle and hog grower, raised by a tax of so much a head on these animals, and part should come from the general taxes levied on all taxable property in the state. Personally I am strongly of the opinion that another portion of this fund should come from the United States government.

To find these tuberculous cattle, or what might be termed ''tuberculous cattle centers,'' we must resort to several different methods. We believe that one of the effective methods will be for cities and towns throughout the country to require that all animals furnishing milk for sale in such city or town must first be tested for tuberculosis by someone thoroughly competent to administer the test. One can readily see that if this method were pursued a large number of infected animals would at once be uncovered and the authorities could proceed to remove these cattle from the various herds found affected.

I started to say that packers are trying as best they can to locate the different shipping points from which tuberculous animals are coming and when these localities are located they are buying the cattle or hogs from these points only at a reduced price or buying them ''subject.'' I know full well that the system of buying subject to inspection is objected to most strenuously by practically all live-stock commission men throughout the country, and I know further that I shall be criticized to a considerable extent for saying that I believe buying subject to inspection is fair both to the buyer and the seller, provided, of course, that the buyer will not in any way discriminate in price when making these purchases, relying entirely on postmortem examination for a protection against any loss on account of diseased animals.

If there is no discrimination at all in the selling price of these animals, I can't see why they should not be sold this way, for in no way do I know how the different farms and ranches on which tuberculous animals are kept can be located in a more efficient manner than to test by postmortem examination the animals coming from these farms, especially from suspected localities. If remuneration were paid for animals slaughtered by public order the owner of the herd in which tuberculous animals were found should be willing to have his entire herd tested out and the disease eradicated. It would be money in his pocket in more ways than one.

All states require that breeding cattle brought into the state must be accompanied by a chart showing that the animals are free from disease or they must be quarantined at their destination and tested at once. In some states all pure-bred animals offered for public sale must be tested and have successfully passed the tuberculin test. I feel safe in saying, however, that the purchasers of at least nine-tenths of these animals require the test to be made before settlement.

I can't see any good reason why there should not be a universal requirement that all pure-bred cattle offered at public sale be tested before such sale and no reactors allowed at public sale. I believe that at the present time every locality should be ready for this requirement. A further protection and a better plan would be to require that no breeding cattle of any kind be allowed to be sold at either public or private sale unless they have first been tested and successfully passed the test.

In order to make this work as effective as possible, there must be a much closer coöperation than exists at the present time between all authorities having to do with the interstate shipment of live-stock. For some reason or other our live-stock sanitary boards and commissions seem to hold to the idea that they will make the rules and the regulations pertaining to their own state in the way they may see fit and let every other state do the same thing.

Some states are not protecting themselves as well as they might from receiving cattle affected with tuberculosis, as they allow cows and bulls for feeding and grazing purposes to come into the state without being tested. For instance, cattle of this kind can be brought into the state of Nebraska from any point on what is called a feeders' and grazers' permit; that is, the owner of the cattle simply makes a statement that the cattle are to be used for feeding or grazing purposes only. In many instances cows admitted into the state on these permits are afterward sold for milk and breeding purposes, and no one knows whether or not they are afflicted with tuberculosis, because no test has been required.

To prevent this I suggest that rules be adopted providing that cattle brought into the state for feeding and grazing purposes be automatically placed in quarantine and that they be released from the premises to which they are shipped only under certain conditions—namely, to be sent to market for immediate slaughter, or they may be released after they have successfully passed the tuberculin test, or they may go under quarantine onto other premises for feeding and grazing purposes only, when permission is given for their removal by the live-stock sanitary board or the state veterinarian. One mistake that is being made in this connection is the erroneous idea that some people have that there is no danger whatever from this disease among range cattle, believing that range cattle are never affected. Everyone familiar with the facts knows that in some range herds there is a high percentage of tuberculous cattle.

In still another manner some cattle get into some states without being tested, and that is by the ''feeding in transit'' billing. Cattle are billed to a market point with the privilege of stopping and feeding. Oftentimes at these feeding points the owner disposes of all or part of the shipment at prices that justify his selling; of course, losing the freight from the feeding point to destination, which is quite immaterial. Cattle sold in this manner are not tested or quarantined, and no account of them is kept at the office of the state veterinarian unless provisions are made that such cattle are placed in quarantine on the premises to which they are taken.

I have stated that in the work of cleaning up tuberculosis among cattle there should be remuneration to the owner for such cattle as may be slaughtered by state authority after they have reacted to the test. The basis upon which payment should be made to the owner is a matter for serious consideration. In making a basis for payment the only question to be considered is absolute justice both to the owner of the cattle slaughtered and to the public at large, which pays for them.

Upon investigating this matter I found a great many different plans for making these payments. I like, however, the one being used by the Bureau of Animal Industry in the District of Columbia better than any other. The basis for settlement for animals slaughtered in the District is as follows: Appraisement of the animals is made by the owner and a representative of the bureau. Those reacting to the test are slaughtered, and if no lesions of tuberculosis are found in the carcass on postmortem examination, 100 per cent of the appraised value is paid to the owner. If localized tuberculosis is found and the carcass passed for food, eighty per cent of the appraised value is paid, and if postmortem examination shows the disease to be generalized and the carcass unfit for food, forty per cent of the appraised value is paid. In all cases the amount received for the carcass is paid into the United States treasury and a warrant for the full amount of the payment to be made to the owner is drawn in his favor.

I find some states pay fifty to sixty to seventy-five per cent of the appraised value, regardless of the condition of the carcass, and in addition the owner receives the carcass value. In some instances where this plan is followed the owner will receive more than the full appraised value of the animal. This applies where the carcass is passed for food. The position taken by the bureau in reaching these percentages is that in the case of the disease being generalized the animal is really of very little value to the owner. At the same time it is beneficial to the public at large to get rid of this animal to the extent of at least forty per cent of the appraised value. The same line of argument holds good as regards the other percentages of payment.

I would provide that no indemnity be paid on any animal from a herd unless all the animals in such herd were tested, and I would also require from the owner of such herd an agreement that he would not take into the herd any animal that had not passed the tuberculin test, administered by someone satisfactory to the state authorities. I would also require that where reactors are found in a herd and the state remunerates the owner for the slaughter of reactors, the owners of the herd be required to have the herd tested every six months for two years and annually thereafter.

I am thoroughly convinced that the disease can be controlled and in time entirely eradicated from the herds of the United States if the cattle owners and the authorities but make up their minds that it can be done. I want to caution the authorities not to be too drastic in their attempts to eradicate the disease. They must realize that cattle owners and the public at large are not as conversant with the disease, its dangers and the economic loss directly resulting from it as are the authorities dealing with the question. I feel sure that in most cases at least where diseased animals are found in a herd the authorities can, if they will, by kindly methods and good advice, get the coöperation of the owner to the extent that he will willingly allow all diseased animals to be slaughtered and buy none but tested animals and have his herd tested again at proper intervals.

I hope that the consumers, especially of milk and its products, will realize the position of the cattle owner in dealing with this trouble, and I feel sure that if the consumer is thoroughly conversant with the facts he will be willing and glad to pay a little increased price for his milk if he can but know that it comes from cows that are absolutely free from this disease.

At the present time efforts to eradicate the disease absolutely from any particular state or territory by the method of requiring all animals to be tested and reactors killed, are sure to meet with defeat, for the simple reason that the public at large is not ready for any such movement. We must go slowly and educate the cattle owner and the consumer of cattle products, showing them just what the disease is and how seriously it may affect them.

1

BOVINE TUBERCULOSIS

By J. F. DEVINE

Realization of the direful nature and alarming extent of tuberculosis as affecting mankind is made clear when we consider that statistics show that one-seventh of all deaths in the human family and one-third of all deaths during ''working age'' are due to tuberculosis. The tribute in human lives and money levied annually upon the people of this country by this disease is appalling; and to allow it to continue when the necessary knowledge and means to mitigate it are within our grasp is little less than criminal. Its widespread prevalence among dairy animals and the varied attendant disasters can only be realized by reviewing the many angles at which it attacks the dairy interests.

While we can safeguard to some degree the health of the consumer by cooking the flesh of animals and pasteurizing dairy products, still such practices do not strike at the real evil. They deal with the effect and not the cause. The source of such infected products still remains the center for the dissemination of the disease to susceptible creatures. A systematic attack should be made on the source.

These statements are not made for the purpose of suggesting revolting conditions but to direct attention to existing evils which demand consideration and correction. Sporadic efforts to control tuberculosis by the state and the individual will avail little if stubbornness and ignorance are ever attacking and denouncing these efforts. This is not a disease for physicians, veterinarians and stockmen alone to combat nor for the legislature to suppress by law. It is a foe whose overthrow needs the combined skill, vigilance and patient efforts of all citizens.

The cause and characteristics of tuberculosis have been worked out and proved by careful, conscientious scientists in the field and laboratory, by numberless observations on human beings and similar observations and experiments upon experimental animals. Therefore, by putting in use our present knowledge concerning this disease and with the intelligent stockmen coöperating with the well trained, careful veterinarian, tuberculosis can be bred out of our dairy herds without serious financial loss or the crippling of our dairy interests.

While the cause and characteristics of tuberculosis are now fairly well understood, the *best methods* of control and eradication are still under investigation. We will gladly yield to any change that increased knowledge may suggest to enhance the efficiency of our present methods of warfare on this scourge.

Radical methods are not sound, since the very nature of tuberculosis forbids the probability of its immediate eradication. What is most needed is the sincere coöperation of all citizens and especially those interested in public health and our live-stock industry, in applying the knowledge we now have, which if imperfect is nevertheless effective in reducing tuberculosis.

History

Tuberculosis, consumption, white plague, and phthisis, are names commonly applied to the disease in man; tuberculosis, consumption, and grapes, in cattle; tuberculosis and ''getting light,'' or ''going light,'' in chickens.

Medical records indicate that tuberculosis is one of the oldest diseases recognized as affecting mankind. It seems to have been known by the Jewish people during their Egyptian captivity, as their laws directed that the flesh of animals which suffered from scurvy (later known as tuberculosis) should not be used for food.

In 1865 Villemin proved the infectiousness of tuberculosis by inoculating rabbits with material from human subjects. Later, he showed that the disease could also be transmitted by feeding or inhaling tuberculous material. These experiments proved the transmissibility of the disease from one species to another. This was followed by the discovery by Koch, the noted bacteriologist of Germany, in 1882, of the specific bacterium which he proved beyond doubt to be the cause of the disease. This led to the view that tuberculosis of all species of mammals was identical and brought about renewed interest in the control and suppression of bovine tuberculosis as a necessary safeguard to human life and health. This movement attracted widespread attention and received vigorous support in the latter part of the last century, until the announcement by the late Prof. Koch at the tuberculosis congress in London, July, 1901, of his opinion that owing to the difference in morphology, virulence and culture of the two types,—human and bovine—(a fact that had been observed by Dr. Theobald Smith in 1896) danger of transmissibility was highly improbable. Further inquiry into this important phase of the subject developed evidence that warrants conclusions at decided variance with the opinion of this great man.

In a recent report of the research laboratory of the department of health of the city of New York, Doctors Park and Krumwiede give results of study of some five hundred cases of human tuberculosis that had been examined during the preceding three years to determine the nature of the infection. This report shows that about ten per cent of all *fatal* cases of tuberculosis in infancy is due to bovine infection, and they add that in selected cases from foundling asylums, where the infants necessarily live entirely upon the ordinary commercial milk, the percentage of bovine infection is much greater. They further state that they found that about twenty-five per cent of glandular tuberculosis in children is due to bovine infection, but in adults examined the percentage of bovine infection is very small.

In the final report of the British Royal Commission we find that in the examination of the sputum of twenty-eight cases of pulmonary tuberculosis in young adults, two were positively of bovine infection. The commission further reports the examination of twenty-nine cases of primary abdominal tuberculosis: of these fourteen showed bovine infection; thirteen, human; and two a mixed infection of human and bovine bacteria. The ages of the children showing bovine infection were from one to eight years.

While the object of this volume is to deal with tuberculosis as a loss to our live-stock industry, still now that the frequent transmissibility of bovine tuberculosis by raw milk to infants has been positively proved, any assistance we may give in the guarding of human life *adds to the importance of the work.*

Contributory Factors in Spreading Tuberculosis

Among the many problems to which the progressive stockmen must give attention is the eradication of tuberculosis and the rearing of healthy young bovine animals. While many conditions such as heavy feeding, inbreeding, close housing, etc., have contributed to the spread of tuberculosis, there are two causes which stand out as perhaps the greatest factors. They are the *traffic in cattle and the feeding of milk containing the living germs of tuberculosis to young calves.* The disaster of cattle traffic is seen in our large dairy herds where it is the custom frequently to purchase animals to replace those which are not productive or have "gone wrong," *without special care to determine whether or not these animals are free from tuberculosis.* The danger of infected milk has often been made plain, particularly in herds where it is customary to feed the calves *raw skim milk taken from the miscellaneous supply given out by creameries.* These customs have proved so disastrous that in an attempt to save the dairy industry some states have instituted an educational campaign on the nature and characteristics of tuberculosis; adopted laws seeking to prevent the sale of bovine animals known to be diseased, as well as encouraging its eradication by giving assistance in the way of nominal indemnity for animals found to be diseased.

The peculiar nature of tuberculosis, its slow, subtle progress in most cases, the lack of any pronounced symptoms ordinarily until the disease is quite advanced, are dangers that are frequently greatly increased by the attitude of the struggling dairyman who resents advice or rigid inspection of his dairy cattle, and his unwillingness to believe or admit the probability of his animals being diseased.

The older countries have recognized these obstacles and some have been endeavoring to overcome them by practical methods which will be discussed later.

The prevalence of tuberculosis, especially among cattle and swine, stands in intimate relation to the development of agriculture. The danger of tuberculosis to the cattle industry lies in the fact that the average age of usefulness in the dairy animal has decreased in a noticeable proportion to the increased prevalence of tuberculosis. Large dairy establishments suffer comparatively greater losses than smaller ones. The raising of young animals is attended with greater difficulty and expense, the volume of milk produced by the infected herds is decreased, and the emaciation which some animals suffer reduces their food value.

The large number of carcasses condemned in whole or part as unfit for food purposes annually by the federal

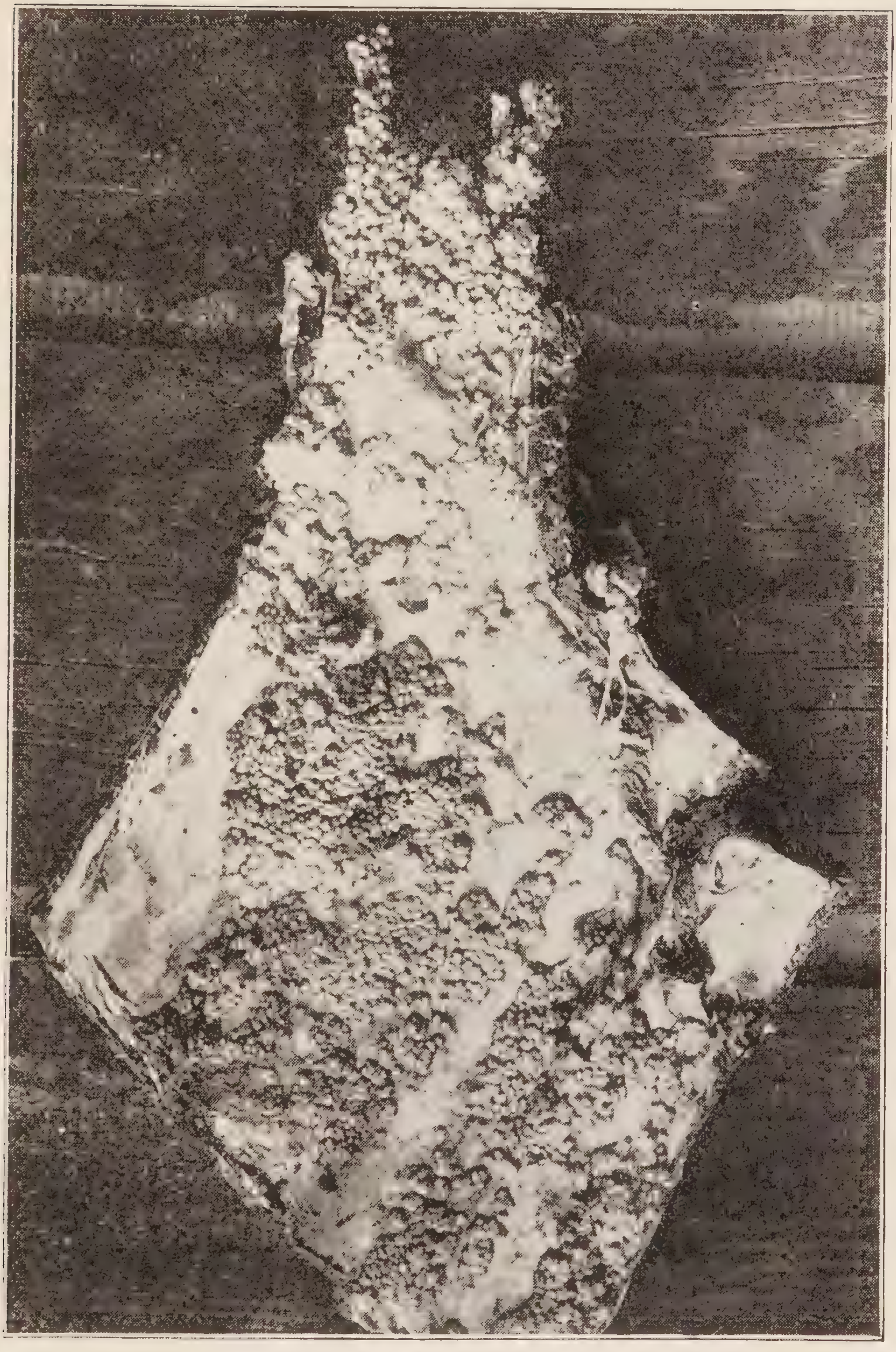

FIG. 1. TUBERCULOSIS LESIONS OF THE PLEURA.

government, is no inconsiderable loss to the national wealth and an idea of this may be had by referring to the annual report of the federal department of agriculture for the year 1914. It must be understood, however, that only about sixty per cent of the animals slaughtered in the United States are slaughtered under federal inspection; of these there were condemned, in 1914, 29,738 whole carcasses and 44,975 parts of carcasses of beef animals as affected with tuberculosis. It will, therefore, be seen that of five million beeves sent to these abattoirs for slaughter that year eleven per cent were more or less affected with tuberculosis. The susceptibility of calves to tuberculosis is also strikingly manifest by the fact that out of 1,814,904 examined the entire carcasses of 45,000 in round numbers were so badly affected as to warrant condemnation. The condemnation of great numbers of sheep, swine and goats is also occasioned by tuberculosis. We should bear in mind in connection with this, that tuberculosis is not nearly as prevalent in beef animals as in dairy animals. It is needless to tell those who are familiar with the source of our meat supply that even a greater percentage of the animals that are not slaughtered under inspection are affected, since the unscrupulous vender purposely avoids inspection, knowing well that a large proportion of animals rejected from dairy herds would not pass an efficient inspection, so he slaughters them in some out of the way place, removes such evidence of the disease as he can and sells them to the unsuspecting public.

There is little doubt that the toxemia which exists in some of the carcasses that have been affected with extensive tuberculosis and other diseases, causes much of the mysterious ailments and digestive derangements that ofttimes puzzle physicians.

That this condition prevails under our advanced civilization is a disgrace to our intelligence; still we are helpless to effectively control or prevent these conditions without *state meat inspection laws* to prohibit the offering for sale of meat that has not been slaughtered under proper inspection.

Certain Carcasses Fit for Food

It might be well to explain here more in detail why animals condemned by tests as affected with tuberculosis are sent to abattoirs, slaughtered under inspection and the whole or part of such carcasses passed for food. The principle of this method rests on:

First, that it would be wanton wastefulness to destroy every carcass that is slightly tainted with tuberculosis when meat is so scarce and its value so high unless there is danger of its being harmful.

Second, science has satisfactorily determined that owing to the nature of the disease the muscles or parts of animals that are ordinarily eaten are not affected with tuberculosis when the disease is manifest in the body in certain places and forms.

To emphasize the economical side of proper meat inspection by referring to the figures given, we can see that if every carcass that showed traces of tuberculosis were destroyed, the federal government in 1914 would have destroyed the entire carcasses of 74,713 adult bovine animals, as against 44,975, and likewise the federal report shows that a half million carcasses of swine would have been destroyed as against 48,252 actually destroyed.

As to the safeguarding of human health and life, under the present method of meat inspection, we must consider that meats are usually subjected to some form of heat before being consumed, while milk, in the past, has been largely used in the raw state, particularly by infants. We could also point out that a certain dairy animal might have tuberculosis of the udder and give off tuberculous organisms in her milk, sufficient to contaminate the milk of an entire dairy, or several dairies if mixed in one vat in a creamery, this milk being capable of infecting a great number of children or calves; and still such an animal could be slaughtered, the udder destroyed, and the balance of the entire carcass be free from tuberculosis. This could likewise hold good where some internal organs are the seat of the disease. To illustrate:—There might be comparatively large lesions of the lungs and the animal's general physical condition so good that nature held the progress of the disease more or less in subjection, and the tissues surrounding the diseased parts would show no evidence of toxemia. If there were no other lesions in the body careful search of all muscular tissue for tuberculous organisms would probably prove negative.

Again we might have smaller lesions that to the untrained eye would appear less dangerous but might be more acute in character and capable of disseminating poisonous products into the circulation. Of course, only those who have special training are capable of determining the character and danger or harmlessness of these lesions. One of the fundamental principles that must not be lost sight of in meat inspection with special reference to tuberculosis, is that while tuberculous organisms may be and are at times transmitted from place to place in the body by the blood and lymphatic streams, still the *blood is not the natural habitat of tuberculous germs.* These organisms have an affinity for certain tissues or parts where they are most constantly found. They are never constant in the blood stream in certain forms of tuberculosis. A careful investigator recently caused considerable surprise in claiming that tubercle bacilli are present in the blood even in the most incipient cases. He was evidently deceived by another acid fast bacillus, since many workers immediately made further observations and proved the statement incorrect.

We should get it clear in our minds that disease-producing organisms differ in their characteristics as do animals, fishes and reptiles. For instance, in the animal kingdom we have animals that are closely related in structure differing in their habits, food requirements and mode of living. An example would be the polar and the black bears, belonging to the same family (Ursidae). We find the former living among the ice floes in the arctic regions, and almost as much at home in the sea as on land, not fearing to swim many miles from shore and feeding largely on marine animals, while the black bear lives entirely on land, swimming only when necessary to cross streams, and feeding upon land animals, berries and fruits.

Among *reptiles* we have the common garter snake and the ribbon snake, both belonging to the same family (Colubridae) and the same genus (Thamnophis). The former inhabits chiefly dry places, although like most snakes it can swim if necessary. Its prey consists largely of insects and small animals captured on land. The ribbon snake inhabits swamps and very often takes to water, living very largely on frogs and aquatic creatures. This same rule applies to parasitic insects: while of the same family, they attack and destroy entirely different kinds of vegetation. In birds we might note the diverse habitations of the barn and chimney swallows.

It might be well to add here the deductions of some noted foreign authorities who have made a life study of this question.

Tuberculous Meat

PART OF SUMMARY OF REPORT BY M. E. CESARI, DU SERVICE D'INSPECTION VÉTERINAIRE SANITAIRE DE PARIS ET DU DEPARTMENT DE LA SEINE.*

Tubercle bacilli of animal origin are capable of infecting man, but it is exceptional to find tuberculosis of alimentary origin in adults, and it is practically only children that are exposed to infection in this way.

The risk of the transmission of animal tuberculosis attaches almost exclusively to milk, the part played by tuberculous meat in causing disease in the human subject being practically negligible.

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*Presented at the Tenth International Veterinary Congress, London, 1914.

The blood of tuberculous bovine subjects may contain virulent tubercle bacilli, but these are always in small numbers. Infectivity of meat, which in a general way is rarely established, occurs in a relatively large proportion of cases of acute miliary tuberculosis—tuberculosis accompanied by marked emaciation, and widespread tuberculosis associated with numerous lesions that have undergone softening, or in cases where a large number of the lymphatic glands are affected and show a pronounced tendency to undergo caseation. The infectivity of tuberculous meat is very slight. The meat is never found to be infective in cases of chronic inactive tuberculosis, that is to say when the lesions are fibrous or encapsuled, although there may be evidence of an earlier generalization of the disease by way of the blood stream.

PART OF SUMMARY OF THE REPORT OF DR. NIEBERLE.*

It is, therefore, the principal aim of meat inspection to entirely remove organs showing lesions of tuberculosis and their associated parts, since it is only tuberculous organs that as a rule contain large numbers of bacilli, the meat itself containing few or none. Since in cases of apparently localized tuberculosis of the lymphatic glands careful investigation frequently reveals the presence of tubercles and bacilli in the organ or organs, complete removal of these is imperative, even if only the glands are diseased, etc.

**Obertierarzt in Hamburg,* presented at the Tenth International Veterinary Congress, London, 1914.

Cause

The cause of tuberculosis is a microscopic organism known as the *tuberculosis bacterium or bacillus.* It should be clearly understood that this organism and this alone is the cause of the disease. The old notion that coughs, colds and the like are the cause of tuberculosis, is erroneous. While it is true that these and poorly lighted and badly ventilated stables, lack of nourishment, etc., do weaken the body and lessen its resistance to tuberculosis or any other disease, still if the *specific organisms* that cause the disease are not present in sufficient quantities, these exciting or predisposing causes cannot produce the disease. To illustrate, we might have a field plowed, harrowed and fertilized and in ideal condition to grow a crop of wheat so far as fertility is concerned, but we must sow the wheat if we are to expect wheat to grow. Fortunately, the organism causing tuberculosis does not propagate itself outside of the animal body except under certain artificial conditions, such as are afforded in a laboratory on a suitable medium and in a favorable temperature. It is the present belief that such conditions do not exist in nature in the soil, air, water or living vegetable matter. This knowledge is useful in the application of fresh air, sunlight, and disinfectants in controlling the disease.

Since tuberculosis is due to a specific cause we speak of it as a *specific disease,* but it differs from some of the other specific diseases with which we are familiar. The indefinite period of incubation and the fact that the disease is usually insidious and slow in its development, often making a diagnosis impossible without the aid of laboratory agents, are two serious factors in the control of the disease. In most communicable diseases there is a fairly definite period of incubation, so that we may reckon with some accuracy from the time the person or animal is exposed until the time he will come down with the disease or may be considered as having escaped infection. With tuberculosis, the question of whether or not an animal may succumb to the disease after exposure covers many phases and often a long period. The organisms *may enter the system and be held in check for a long time,* but should the animal be badly cared for or become affected with other ailments, the disease then may make rapid progress. Knowing this, the progressive dairyman strives to give his dairy animals the best of care. At present he is paying particular attention to well ventilated and well lighted stables, since it is quite plain that badly ventilated and poorly lighted stables not only favor

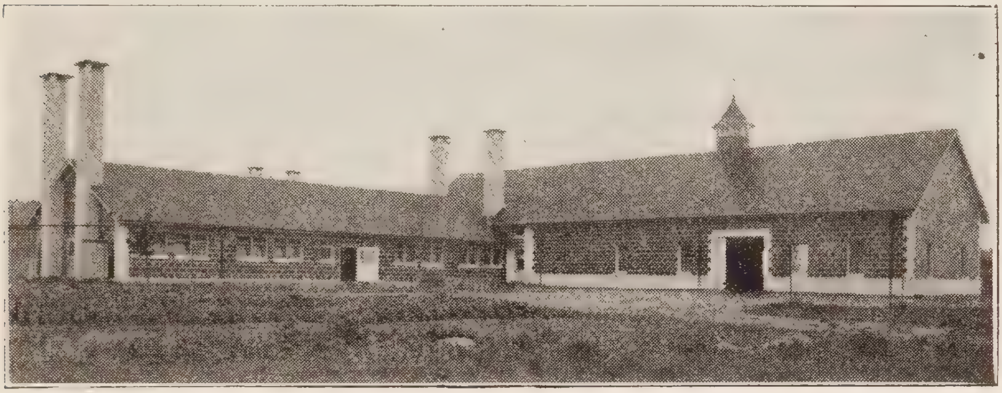

FIG. 2. HIGH CLASS DAIRY AND FEED BARN

Note the many windows opening at the top and the ample size of the ventilating shafts.

the *virulence of the germ, but lessen the resistance of the animal.*

Tuberculosis again differs from most specific diseases in that such diseases usually run a *definite course* and if the afflicted one recovers and the disease leaves no sequel, the individual is likely to regain normal health and be as well as prior to the illness, some diseases even leaving limited or permanent immunity. This is not so with tuberculosis; when infection is once established, the germs do not cause illness by the toxins which they secrete, and after a certain period cease their activity, as they do, for example, in a non-fatal case of diphtheria; but being parasitic in nature, they continue to live and multiply upon the tissue of their host and if not checked or arrested, they eventually destroy the parts or organs

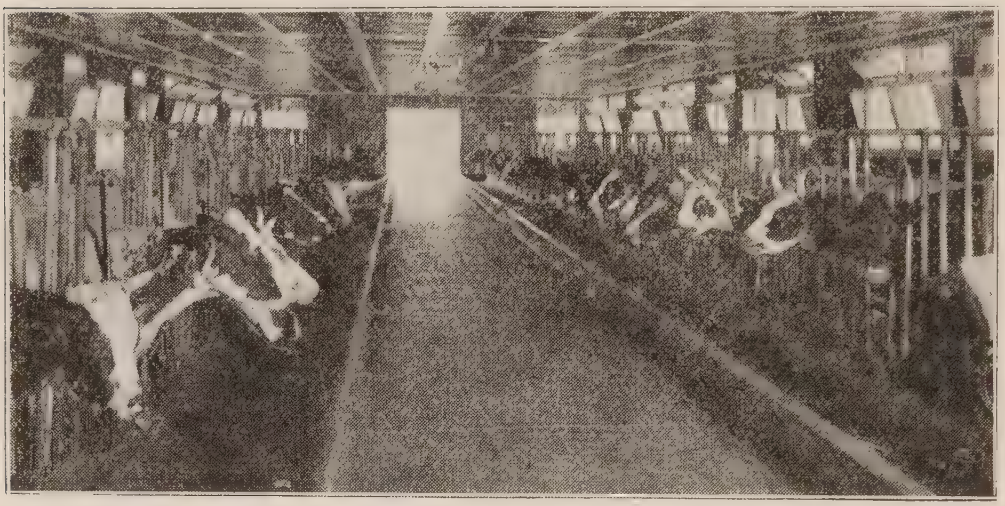

FIG. 3. INTERIOR VIEW OF DAIRY BARN SHOWN IN FIG 2

Note the excellent provisions for good sanitation, the ample light, the metal stanchions, the cement floor and feed troughs, the tiled ceiling and again the large ventilating shafts, movable metal partitions in the feed troughs, and perhaps more provision for ventilation in inclement weather when the windows must be closed would be an advantage.

in which they locate. The organisms multiply by the process known as fission—two dividing into four, four into eight, etc.—each of these in turn destroying more of the animal tissue, and hence there is often much truth in the statement that a man or animal suffering from tuberculosis has lost a part or whole lung. The parts or organs in which the germs locate often have great influence as to how rapidly the disease progresses or as to what effect it has upon the general appearance and health of the animal. It is, therefore, possible for some animals to have extensive lesions and still present a splendid physical appearance. This is noticeably so where the lesions are largely confined to the lymphatic glands or the pleura and peritoneum.

Another characteristic of tuberculosis, and one which makes it very deceptive and treacherous, particularly to the layman, is that the so-called curing of tuberculosis is very uncertain and insecure. Stockmen ofttimes argue that cattle that present a good physical appearance but have reacted to the tuberculin test, should not be considered as permanently diseased but should be allowed to be cured the same as they are led to believe that human beings are cured. They fail to note that the people who apparently recover from a mild infection of tuberculosis do not continue to live in the same environment and under the same conditions in which they contracted it. In other words, would any physician advise a factory worker who developed tuberculosis to continue in the same work and confinement, with the hope of being cured? The stockmen should realize that as soon as tuberculosis is diagnosed in the human subject, he is advised to live with great caution under certain conditions. The diet, exercise, sleeping quarters, etc., must be suitable and this, too, must continue for an extended period, often throughout the greater part of his life. Even under these conditions it is the writer's opinion that *permanent* and *positive* recovery is a rare thing where tuberculosis has been at all advanced. This condition of life is not practical with dairy animals, excepting in very unusual cases; first, because their life is comparatively short; secondly, most dairy animals are kept for the profit of producing and reproducing, and if this is not exacted of them they cannot be classed as dairy animals.

There is still another danger of tuberculosis that seems to be entirely overlooked in the argument of the stockman that an animal should not be condemned as tuberculous and isolated as such when it appears physically sound and may have but small lesions. In presenting these arguments they forget the treacherous nature of the disease. Those who have had occasion to practice veterinary medicine in dairy districts see the insidious side too often exemplified—how an animal in the pink of condition, possibly one of the best producers in a dairy, suddenly becomes stricken with a comparatively simple ailment, such as foul hoof, retention of the placenta or the like, and how this animal may immediately begin to lose flesh, taking on a haggard look, the eyes beginning to sink in their sockets and death ensuing, no matter how intelligently and carefully the animal may be treated and cared for. These occurrences are so numerous as to be almost diagnostic in herds where tuberculosis exists to any great extent. In contrast to this, we notice that where we have herds free from tuberculosis, the treatment of common ailments is simplified and the results far more certain and satisfactory.

The susceptibility of cattle to tuberculosis is more alarming than the public seem to realize. In order to rid dairy herds of this scourge it is imperative that dairymen guard against quartering healthy animals with diseased ones and recognize the danger of tuberculous matter in any form being taken into the digestive tract of exposed animals.

Having this information concerning the nature and character of the disease, the next thing of interest is the modes of infection.

Modes of Infection

While there are several ways of infection, particularly in localities where the disease is very prevalent, still by far the most common are:

(*a*) By the introduction into the digestive tract of material contaminated with tuberculosis organisms.

(*b*) By the inhalation of air similarly infected.

Therefore, the feeding of animals, particularly young animals, with food, *principally milk,* containing tuberculosis bacteria, is one of the surest methods of infection. *The danger of putting healthy animals into an infected stable or bringing diseased animals into a healthy herd* is also at once apparent.

Diagnosis

The two most practical methods that we have today for determining the presence of tuberculosis are:

(*a*) The physical examination.

(*b*) The various tuberculin tests (the subcutaneous, the intradermal and the ophthalmic).

Unfortunately, the physical examination cannot be relied upon in the majority of cases. It is the opinion of some authorities that a large percentage of the so-called "spreaders" (animals which are giving off tuberculous organisms more or less constantly) can be detected on a careful physical examination made by a thoroughly trained veterinarian. While it is our opinion that many of the "spreaders" may be detected by such an examination, still we question if a large percentage of all "spreaders" could be so determined. The arrest and progress of the disease, the healing and breaking open of new and old lesions which are so characteristic even in well nourished animals, would have much influence on the accuracy of this method in determining whether an animal is or is not a "spreader."

In attempting to control and eradicate tuberculosis, the physical examination alone would make slow progress, since experience has taught that in a large dairy herd well cared for and well nourished, we may have a high percentage of tuberculosis with but few of the animals showing any positive clinical symptoms of the disease, but many of the unsuspected ones being found badly diseased when slaughtered and the internal organs exposed. As long as such animals are allowed to remain in a dairy herd as centers of infection, all efforts and money expended in ridding that particular herd of tuberculosis are practically wasted.

The physical examination has some merit in *reducing* tuberculosis. This is particularly so in advanced lung cases and tuberculosis of the udder, two forms which are obviously very dangerous, the one giving off tuberculosis germs in the discharges from the lungs and the other giving off germs in the milk, which acts as a splendid medium for the nourishment of the germs and at the same time is usually consumed in a raw state. However, by reviewing the symptoms of tuberculosis we at once weaken any argument in favor of physical examination alone.

Symptoms

The symptoms of tuberculosis may range from simply the presence of organisms in some of the secretions and excretions, without the slightest sign of disease so far as physical appearance goes, to the most dejected and emaciated animal that it is possible to picture. Stockmen sometimes state that they can tell as well as any veterinarian or any test when one of their animals has tuberculosis. This idea is often very unfortunate for the stockman, in that he is simply *fooling himself.* For instance, an animal may have tuberculosis of the pleura, peritoneum, liver, intestines and great numbers of the lymphatic glands, and possibly be giving off the tuberculosis germs in great numbers both through the digestive tract and in the milk; in fact, such an animal may be a veritable living manufacturer and distributor of tuberculous germs, and still remain for a time one of the sleekest and best looking animals in the herd. This has been repeatedly proved by examination of milk and body discharges, the tuberculin test and post-mortem findings. Therefore, we can realize how hard it would be to attempt to lay down any rules whereby tuberculosis could be diagnosed by a physical examination alone with any certainty. The best we can do is to enumerate some of the conditions which are likely to be present and observable when the disease is located in certain parts or organs.

Acute or quick tuberculosis is rather rare in animals, excepting when complicated with other acute ailments. It is usually slow and chronic in type. No body organs or tissues seem to be immune to the infection, though certain tissues are more susceptible than others. For instance, post-mortem records show that a large majority of bovine animals have the lymphatic system affected, particularly the retropharyngeal glands, which are located in the region of the throat; the bronchial and posterior mediastinal glands, located along the trachea, and between the lungs, occasionally the prescapular glands, located at the shoulder, and the precrural glands, located in front of the stifle. The organs which are most frequently attacked are the lungs, liver, intestines and udder. The old notion seems to still prevail that when a man or animal has consumption the lungs are the organs that must be involved, and that unless a man or animal breathes very irregularly and coughs incessantly, tuberculosis cannot possibly be present. As we have stated, the lungs are commonly the seat of tuberculosis, either mild or extensive, and when extensive a physical examination usually reveals certain conditions. But again, if the lower parts only of the lungs are affected, it is quite possible that the cough may be absent and percussion and auscultation will give us very little positive information in these cases.

When the pleura is affected, the animal may walk stiffly, groan and exhibit pain on pressure upon the walls of the chest and often may have a slight painful cough. Again all these symptoms may be absent.

Tuberculosis of the lymphatic glands may be detected if the affected glands are located in a region where they can be palpated or handled. When infection is confined largely to the trachea and the lymphatic glands along its course, there may be catarrhal symptoms with more or less discharge of a mucous character and an occasional cough; or if the glands should become so enlarged as to cause considerable pressure upon the trachea, the cough may be more persistent and severe. Again one of the common sequences of the enlarged glands along the trachea, particularly the one known as the mediastinal, is repeated bloating of the rumen due to pressure of the gland on the esophagus. Veterinarians experienced in cattle practice immediately suspect this when animals become chronic bloaters and do not respond to the usual treatment. This condition can usually be accurately diagnosed by passing a probang or stomach tube. What is true of the thoracic organs is also true of the abdominal organs.

Tuberculosis of the peritoneum may reach an advanced stage of development before it manifests any outward indications. In cows, however, where the processes spread to the serous coat of the sexual organs, it ofttimes causes unusual excitement and sterility, or if they should conceive they are more likely to abort than if not affected. In the later stages of the disease this excitement may be so continuous as to cause nymphomania; while most animals are apt to lose flesh under these conditions, still some may even take on flesh more rapidly than usual. The uterus of the female and the genital organs of the male are occasionally affected. This can usually be determined pretty accurately by manual examination. These organs, however, are rarely affected and the large majority of animals in which tuberculosis is diagnosed only by testing are quite safe to use as breeding animals.

Where there is extensive bowel involvement there is quite likely to be diarrhea. This in time is likely to cause emaciation. The effects upon the general system when the disease is located in the liver or spleen will depend largely upon the location and character of the lesions in these organs.

Tuberculosis of the udder and the supramammary lymphatic glands is present in about three per cent of animals affected in dairy districts. This form of tuberculosis can frequently be diagnosed by the behavior of the swelling and by palpation. Tuberculosis of the udder usually begins by a rather profuse and painless induration of one or both posterior quarters. Occasionally it may spread to the adjacent quarters and gradually develop into an exceedingly hard nodular tumor causing atrophy of the remaining parts of the gland. In other cases it may be observed that after the udder has been milked dry one can feel several nodules. These little tumors are firm and painless and may remain apparently harmless for a long time. Again the udder may appear perfectly normal and the supramammary lymphatic glands above the udder be slightly enlarged and gradually increase until they reach the size of a child's head. In rare cases these irregularities of the udder may begin with the usual appearance of traumatic inflammation as if the parts had been bruised in some way. All these conditions as they advance are apt to affect the appearance and consistency of the milk. In a large percentage of these cases it is found that the milk contains tuberculosis bacilli.

If lesions are extensive either in the thoracic or abdominal organs or both and are located in vital parts of these organs so as to materially interfere with their functions, we would expect great emaciation and weakness and perhaps a painful, weak cough, diarrhea, etc. These are the cases that the stockman can easily detect, but they have long been dangerous before they reach such a stage, and if an animal so affected has lived in a dairy herd for any length of time, particularly during the season when animals are closely housed, it has no doubt infected a large majority if not every animal in the herd.

It will therefore be seen from this brief description of the symptoms which tuberculosis may cause, that symptoms are not constant and may be indefinite and misleading.

Tuberculin Test

In order that we may better understand what tuberculin is, it might be well to briefly recite how it is prepared. A tube containing glycerinated bouillon is inoculated, usually with human tubercle bacilli, and then placed in an incubator where a proper temperature (about 37° C.) is maintained. Here it remains until the growth ceases, which usually takes from four to ten weeks. This growth is twice heated to a high degree and filtered, which effectually kills all germs and renders the substance sterile. It is generally known even among laymen that boiling and filtering are effective ways of making drinking water safe. This filtrate is then diluted with sterile water to which is added a small amount of carbolic acid, carefully bottled, hermetically sealed and so kept until needed for use.

Tuberculin was first prepared by Dr. Koch in 1890 with the hope of its being a curative agent, and while it showed in certain ways a tendency to *assist nature in healing mild infection,* his fondest hopes were not realized. His work, however, was not all in vain, as it evolved a most useful diagnostic agent, and we can safely state that *properly prepared tuberculin in the hands of a thoroughly trained and careful operator is one of the most accurate diagnostic agents known to man.*

Tuberculin is not infallible; it errs, *not in condemning animals that are free from the disease, but in the cases it does not detect. When properly prepared tuberculin is carefully applied and the results capably interpreted and* *tuberculosis is indicated, we can count with certainty that the animal in question is tuberculous.* It may be that the lesions are recent and minute, or deep seated and obscure in the bone, brain, or spinal cord, or remote places not easily detected, but they are there if we search far enough for them. These facts have been so thoroughly established that it is not now the custom of officials to mutilate a carcass and *destroy its food value* simply to locate the lesions. Experience has taught us that this is unnecessary and wasteful. The argument is sometimes put forth by persons who are uninformed as to what tuberculin is, and who are antagonistic to its use, that it can produce tuberculosis. It would be equally logical to insist that a glass of wine would grow a vineyard in a man's stomach.

Unfortunately there are certain conditions which may influence the test and make the results inaccurate. Among the conditions which may cause this are: (*a*) irregularity in caring for the animals at the time of test; (*b*) exposure to extreme temperatures, particularly the sun's rays on a hot day; (*c*) irregularity in feeding, which is more noticeable in young milk fed animals or in animals unaccustomed to being handled; (*d*) animals in heat, and advanced pregnancy. The influence of the latter, however, has been greatly over-estimated in the opinion of the writer.

Tuberculin also has its limitations. In animals which have recently become infected with the disease and are still in what is termed the incubative stage, or in animals in which the disease is fairly advanced and has become arrested, the lesions being encapsulated so that the tuberculin does not reach the diseased tissue, the test may not be effective. Its accuracy also may be influenced where tuberculin has been recently injected or where an animal has been repeatedly treated with it. There is still another condition when animals are affected with what is termed advanced tuberculosis in which the lesions are so extensive that a small dose of tuberculin apparently has little or no influence on the substance acting upon the heat centers. This form of tuberculosis, however, is ofttimes readily diagnosed by a physical examination. There are likewise certain tricks which the dishonest resort to, to interfere with the accuracy of the tuberculin test, that are largely within our power to avoid, when we have reason for suspicion. For instance, the fraudulent use of drugs, large draughts of water, etc., may usually be avoided by close application in conducting a test. By making primary tests always very carefully and conscientiously the number of diseased animals which escape this test will be reduced to a minimum.

One thing of great importance which should be impressed upon all inexperienced workers in the detection of tuberculosis, is that *the first test is the test we should rely upon for the most definite information as to the extent of tuberculosis in a herd,* and we would add that, from experience it is our belief that wherever possible, early spring is the time to make this initial test of dairy animals. The close contact and want of living in the open and the usual heavy feeding for the production of winter milk combine to lower the resistance of the animal body, with a resultant more active tuberculosis in the infected animals at this time of year than in the fall or early winter when the return to nature during the summer months has checked and closed many of the lesions and consequently there is interference with the accuracy of the test at that time. It too often happens that the producer of winter milk buys his "springers" in the fall and even though infected they pass a satisfactory test after a summer on pasture and react the following spring for the reasons we have mentioned and the seller and perhaps the veterinarian who made the first test are unjustly accused of dishonesty.

The fact that the injecting of tuberculin influences lesions, more or less, in infected animals and particularly in those mildly infected (such lesions ofttimes showing a pronounced tendency to heal while in other animals producing a temporary immunity or toleration to tuberculous organisms or some change which interferes with the phenomena occurring at the time of reaction), adds emphasis to the advantage of a careful initial test. The present custom in retest work is to resort to large doses of tuberculin, beginning the recording of temperatures early after injection and continuing for a longer period than in an initial test in anticipation that the reaction if interfered with by reasons we have discussed may occur unusually early or at a late period. It is the writer's opinion that the results obtainable by beginning taking the post-injection temperatures earlier than eight hours after injection are not in keeping with the additional labor and hardship it usually entails, and we predict that this custom will be abandoned in due time, excepting in special cases. Experience has satisfied us that delayed reactions are rather frequent, particularly where an animal has received several previous inoculations of tuberculin.

Directions for Making a Thermic Tuberculin Test

While the federal and the various state and municipal authorities lay down rules and regulations that are to be followed where specific aid is sought or to meet certain requirements, it is unfortunate that up to the present time all of these rules and regulations are not uniform; as a rule, however, they differ but slightly and the trend is toward uniformity as the work develops.

We here give what we believe to be a fair and reliable way of making a tuberculin test without the idea of meeting any particular requirements other than attempting to determine which animals are tuberculous and which are not.

(1) Make a very careful physical examination of each individual for evidence of any disease or abnormal condition that might affect the reliability of the test.

(2) As large a number of preliminary temperatures as possible should be got. Take at least three temperature measurements prior to the injection of tuberculin. It is advisable that two of these temperatures be taken in the forenoon if possible. The interval between all preliminary temperatures should be at least two hours. Any animal showing pronounced abnormal preliminary temperatures should not as a rule be injected.

(3) The dose of tuberculin should be stated by the

manufacturer on the container. In all cases where a tuberculin test has been made within six months or where an animal has been repeatedly injected with tuberculin a double or larger dose should be given.

(4) Inject tuberculin by means of a hypodermic syringe into the loose subcutaneous tissue either in front or behind the shoulder, or any convenient place. The syringe should be carefully disinfected before using and the needle before injecting each animal. For the former a five per cent solution of carbolic acid or any other reliable disinfectant may be used; for the latter it is sufficient to dip the needle into the liquid without removing it from the syringe.

(5) Temperature measurements should be resumed not more than *eight hours* after tuberculin is injected. These measurements should be taken at intervals of not more than two hours until at least *twenty hours* after injection. If the temperature of any animal shows a rise above highest temperature of preceding day or any irregular temperature, the temperature readings of such an animal should be continued for a period of at least twenty-four hours after injection or until a definite decision can be reached. Temperature readings of animals that have been injected with tuberculin within six months or that have been indicative of infection at any previous test or that have had repeated injections of tuberculin should be resumed not later than four hours after injection and should be continued for a period of at least twenty-four hours after injection or longer if necessary to make reliable deductions.

We here give the data of a late reaction of a Holstein bull which came under our observation in 1910. Other workers have also recorded similar cases showing that this erratic condition occurs with sufficient frequency to be an important factor particularly in large herds where honest efforts are being made to eradicate the disease.

This bull had been tested twice previously. In the first test, which was conducted carefully, the animal gave no unusual variation in temperature, but the test revealed a large percentage of tuberculosis in this herd at the time of test. The non-reactors were again tested in four months, when the bull gave a typical reaction. He was isolated and at the owner's request was retested with the balance of the herd in six months, receiving a large dose of tuberculin; the temperature readings as here given followed the administration of the tuberculin:

Pre-injection temperatures
101.6 101.6 101.8

Injected
8 P. M.

Post-injection temperatures

5 A. M.	7 A. M.	9 A. M.	11 A.M.	1 P. M.
101.6	101.6	101.5	101.4	101.3
3 P. M.	4.30 P. M.	6 P. M.	7.30 P. M.	9 P. M.
102.4	102.9	103.2	104.6	104.2

It will be noticed from this data that the bull showed no evidence of reaction at his test until the nineteenth hour and but little positive information until the twenty-third hour and gave the highest reaction at the twenty-fifth hour. The postmortem examination showed the presence of tuberculosis in several chains of the lymphatics and tuberculosis of the lungs and omentum.

It will, therefore, be seen by the above that retests are laborious and tedious. It is our belief at the present time that in retest work the subcutaneous test can be beneficially supplemented in certain cases by either the ophthalmic or intradermal test or both. We have had but little experience in this supplemental work, but Hutyra & Marek have this to say regarding the efficiency of the intradermal and ophthalmic tests.

"The intradermal test produces with the use of fifty per cent tuberculin good and fair results in both positive and negative cases. The ophthalmic test is of less diagnostic importance."

Several rather extensive experiments have been conducted in this country recently to determine if possible the relative merits of the different tests used in detecting tuberculosis. The conclusions arrived at are, that while the subcutaneous test involves more labor and expense than either the ophthalmic or intradermal test, the percentage of accuracy is in its favor.

We should like to make our position clear at this point in reference to anybody or everybody making a so-called tuberculin test. Making a tuberculin test does not consist simply in a mechanical procedure of taking temperatures and using a hypodermic syringe. It is our judgment that a man who is not trained in the knowledge of the preparation of biologics and the principles of physiology, comparative pathology and animal diseases, is not capable of making a reliable tuberculin test. In the first place it is very essential that a proper dose of tuberculin be inserted under the skin and not through a double fold of the skin and down the side of animal as we have seen untrained operators do. It is equally important to know that the syringe is working properly and not leaking. While these, of course, are important details that a layman with sufficient practice could become adept at, still there is the probability of any of the many unusual conditions arising that may and do happen in large herds at the time of test, that only a properly trained man is capable of reliably interpreting.

Two questions that are frequently asked in connection with tuberculin testing are:

First. Does the febrile reaction give any definite information as to the extent of the infection in the animal body?

Second. Are certain breeds more susceptible to tuberculosis than others?

We herewith submit the statistics of tuberculin tests and post-mortem findings of 2,002 cases which were conducted under our direction while in state service. These tests were made by different veterinarians under the ordinary varying conditions and circumstances and in our judgment settle the question quite conclusively, with our present knowledge, that we get no definite information by the thermal reaction and that no one breed is more susceptible than another when subjected to similar conditions and environments.

STATISTICS OF TUBERCULIN TESTS AND POST-MORTEM FINDINGS. NUMBER OF ANIMALS CONDEMNED, 2,002.

Number of generalized cases	636
Number of localized cases	1,295
Number of no lesion cases	71

Generalized, about 32%; localized, about 65%; no lesions, about 3%.

Comparative Percentages of Different Temperature Readings of Generalized Cases

Temperatures	102—103	1%
Temperatures	103—104	5%
Temperatures	104—105	19%
Temperatures	105—106	75%

Comparative Percentages of Different Temperature Readings of Localized Cases

Temperatures	102—103	1%
Temperatures	103—104	6%
Temperatures	104—105	21%
Temperatures	105—106	72%

Comparative Percentages of Different Temperature Readings of No Lesions Cases

Temperatures	103—104	30%
Temperatures	104—105	20%
Temperatures	105—106	50%

Number affected with glandular tissues	1,740	87%
Number affected with lungs	821	41%
Number affected with miscellaneous parts and organs	1,001	50%
Number affected with udder	51	2½%

Breed, Number and Percentage of Each Breed Condemned

Ayrshire	76	3½%
Ayrshire Grade	28	1½%
Dutch Belt	8	.04%
Durham	15	.07%
Durham Grade	9	.04%
Guernsey	30	1½%
Guernsey Grade	44	2%
Holstein	280	15%
Holstein Grade	390	20%
Jersey	262	14%
Grade Jersey	206	10%
Native	214	10%
Grade	314	15%
Swiss	40	2%
Swiss Grade	85	4%

Control and Eradication

In discussing the different and varied means of preventing the spread of tuberculosis with the hope of its ultimate elimination much has been said and written, as on all large important questions, that is not applicable and not worthy of repeating. However, many suggestions have received serious attention from stockmen and much useful information has been the outgrowth.

In the control of bovine tuberculosis aside from the important phase of guarding the human family, which is governed largely by the health authorities, there are two fundamental principles to be kept in mind at all times.

First, the proper control of animals already affected with tuberculosis; and second, the prevention of infection of non-infected animals, which includes the guarding of both the healthy and diseased animals. This can and should be done without wasteful slaughter of valuable breeding animals which show no evidence of the disease; or unnecessary destruction of the carcasses of animals slaughtered because of the disease, where the lesions are so confined as to be harmless to the edible portions of the carcass.

While efforts to suppress tuberculosis in mankind have been put forth for many years, its prevalence in animals and methods of dissemination were not considered seriously in this country until its widespread evidence among dairy animals and hogs, forced its attention upon the authorities for economic reasons. We have stated, and it is well here to repeat, that one of the important factors largely responsible for the great prevalence of tuberculosis in dairy districts is the interchange of diseased cattle in replenishing dairy herds; or the establishing of new herds by purchasing from dealers who buy stock at random; the dairyman purchasing them as healthy animals, either from want of knowledge of the seriousness of what this means to his business, or, in desperation, purchasing them knowing of the danger, and believing that at the present time it is impracticable to purchase a herd of tuberculosis-free graded stock. This being the situation, it seems that those who are properly informed on the seriousness of this problem should exert their greatest efforts toward two things: (a) the dissemination of accurate knowledge concerning the disease; (b) aiding in building up tuberculosis-free herds, thereby making it possible for those who are seeking healthy animals to find them readily available.

The fact that heredity plays so unimportant a rôle in the transmission of this disease from parent to offspring and that with few exceptions all animals are born free from tuberculosis, even when born of tuberculous parents, greatly simplifies the rearing of healthy young animals. We will mention and briefly discuss some of the methods that have been advocated in this country with this end in view.

(1) The physical examination and immediate slaughter of all animals apparently affected with tuberculosis. We have already pointed out that while this method would lessen tuberculosis and remove many dangerous animals and in a sense act as a check or control to a cer-

tain degree; still, it is common knowledge that by this method alone we would make slow progress in the eradication of tuberculosis.

(2) Physical examination and tuberculin test, destroying all animals that show evidence of the disease either by the test or otherwise. To anyone with sound knowledge concerning the dairy industry, this method in states where dairy interests are large, and tuberculosis widespread, would be a straight road to ruin. Not only would it cause a milk famine in such states, but it would demoralize the dairy industry and create a sentiment against the dairy cow that would take a century to recover from. Since there are other methods that will equally safeguard mankind and save our valuable breeding animals and make it possible to rebuild tuberculosis-free herds, this method is too radical.

(3) Much thought has been given to the rearing of non-tuberculous animals by immunization of the young. These efforts may be said to bear origin with the discovery of tuberculin in 1890, when numerous workers attempted to immunize animals with tuberculin as well as to produce a serum against tuberculosis by means of increasing doses. This method proved a failure. In 1892-1893 Dr. E. Trudeau was the first to announce that to produce immunity against tuberculosis the living tubercle bacterium must be used. In 1894 Dr. Schweintz used living cultures with success on guinea pigs. In 1901-02 M'Fadydan was the first to demonstrate that injecting living cultures into cattle tended to give protection against tuberculosis. In 1902 Von Behring, Pearson and Gilliland published re-

sults of systematically vaccinating cattle, later exposing them with control animals to infection, and gave the results of careful postmortem comparison. The method of Von Behring and those of Pearson and Gilliland were practically the same, excepting in dosage, and consisted of the intravenous injection of living cultures. Later the vaccine of Von Behring was put on the market under the name of Bovo-vaccine. Other experimenters have done considerable work along similar lines inaugurated by these pioneers, but it seems to be generally admitted that while a certain amount of protection is usually produced in the vaccinated animals there is no certainty of absolute immunity and that sufficiently large doses are dangerous. The short and rather uncertain duration of the immunity conferred is also an objection that must be improved upon if the vaccination of cattle is to be popular and practical.

(4) The subject of control would not be properly reviewed unless we spoke of methods that have been advocated by different foreign authorities, the most noted of whom are Prof. Bernard Bang, of Copenhagen; Prof. Ostertag, of Germany, and Prof. Poles, of Holland. Customs and conditions differ in these countries and their methods naturally vary from each other and they all in turn differ from what we believe to be the best method for the sections of the United States where tuberculosis seems pretty generally disseminated.

(5) The Bang method practically consists of a thorough physical examination and a careful tuberculin test; destruction of all animals showing positive evidence of advanced tuberculosis; the separation of all diseased and

suspicious animals from those passing a satisfactory test (this separation to be permanently and carefully adhered to); frequent disinfecting of stables, yards, etc., repeated thoroughly when a test reveals a new victim; the retesting at intervals of animals that pass the initial test at such times as the extent of tuberculosis indicates. As stated, these retests should be governed by the extent of tuberculosis in the herd. If a large percentage of tuberculosis is detected at first test, a retest should be made at the expiration of three months, another retest in six months, whereupon longer periods would probably suffice for subsequent tests. It might be well to add here that where a high percentage, say seventy or eighty per cent of tuberculosis is detected on the initial test, it will be fully as well to treat the entire herd as diseased. The calves should be taken from the dams as soon as dropped and placed either in a new stable or in one that has been properly cleaned and disinfected for their reception. These calves should receive milk only from cows that have come from a tuberculosis-free herd or cows that have been tested sufficiently often to consider them free from tuberculosis, or upon milk that has been *properly pasteurized.* In order that these calves may escape contagion, it is advisable that they be kept separate and apart from the original herd and that those caring for the original herd, walking about in the excreta, are not allowed to enter the confines of the healthy stock. This method is fairly practical when the law of a state permits the sale of either raw or properly pasteurized milk from reacting animals that show no clinical evidence of the disease. There is an objection to this policy by some purely from an esthetic sense. They would penalize the honest dairyman who attempted to determine which of his animals are free from tuberculosis and which are not, with the hope of isolation and guarding of the young stock, as well as still making his milk safe for public consumption, since the tuberculosis test would enable him to correct any suspicions he might have of any particular animal or animals being affected with tuberculosis. His neighbor, John Smith, may have a herd that, relying on the law of average, is no better than his; he makes no particular effort or test to determine the state of health of his herd, still he is allowed to sell his milk without any restrictions.

(6) Ostertag's method consists in eliminating all cases of tuberculosis that can be diagnosed by clinical evidence; removing the calves from the balance of the herd as soon as dropped and keeping them separate for several months; feeding them on milk from nurse cows which have passed a satisfactory tuberculin test, or on pasteurized milk; and later allowing them to mingle with the other cattle. This custom may be satisfactory in Germany, but anyone with experience knows that there would be a varying percentage of young animals affected in this way and our progressive farmers are too impatient to be satisfied with partial results. The American farmer is just as impatient in reaching the ideal as any other American business man, and is very likely to condemn any half hearted attempt at anything to be undertaken.

(7) Prof. Pole's method, as applied to the Netherlands, is somewhat similar to the Ostertag, but relies

largely upon the clinical examination for the detection of all animals that are believed to be dangerous. How practical this method has been in controlling or eradicating tuberculosis we cannot state other than we were told while visiting the Holland state laboratory at Rotterdam in 1914 that at the present time about sixty per cent of the cattle of Holland are tuberculous. This percentage would hardly bear comparison with our nation and in our opinion does not speak well for their methods.

(8) The method which seems most adaptable to our conditions, and a method that is gaining favor in some states, for herds other than pure-breds and even in pure-breds in some instances, is what might be termed the "modification of the Bang method," which has the advantage of breeding out tuberculosis, with no inconvenience in the marketing of the milk. This method briefly is the frequent physical examination of a herd, so as to eliminate open cases of tuberculosis and treating the whole herd as diseased so far as the progeny is concerned without applying the tuberculin test. By this we mean that the offspring is removed as soon as dropped and treated the same as under the Bang system. The average progressive dairyman does not look upon the inconvenience caused by keeping the young stock separate and the heating of the milk they are fed out of proportion to the many advantages of raising a tuberculosis-free herd. By the time his heifers come in milk his farm usually adjusts itself without much effort or expense. If he conducts a large establishment he usually has additional barns with separate paddocks or pastures. If his establishment is

more modest and he must have the room for the heifers that have reached the age to freshen, the old stock is either then tested and the reactors disposed of, or the original herd is disposed of completely and the young stock takes its place. The Bang method seems to be applicable only to pure-breds in our country, where the great value of the dams and sires of breeding stock warrants the expense, particularly in states where the laws make the handling of reactors and their products so burdensome and annoying. The feasibility of raising tuberculosis-free young stock even in grade herds by the method we have here outlined, while still keeping the original herd, seems to be supported by the findings of the Bureau of Animal Industry as set forth in their annual report dated September 28, 1915, with particular reference to tuberculosis investigations.

''Tuberculosis Investigations''

''Studies on tuberculosis, which have been in progress for a number of years and are being continued, justify several conclusions, as follows:

''(1) That the propagation of tuberculosis among cattle depends more largely on actual contact between tuberculous and healthy cattle than on any other possible cause of infection.

''(2) That no wide separation between stables or pens occupied by tuberculous and healthy herds of cattle is necessary to protect the latter against infectious material discharged by the former.

"(3) That in the preparation of stables which have been occupied by tuberculous cattle and are subsequently to be occupied by healthy cattle or animals, a thorough cleaning is a factor of possibly even greater importance than the use of disinfectants.

"(4) That tuberculosis among hogs depends almost exclusively on the direct exposure of hogs to tuberculous cattle and to material derived from such cattle, and only very slightly on the exposure of healthy to tuberculous hogs."

Conclusions

In conclusion we must admit that tuberculosis is a widespread animal scourge particularly among bovine subjects; that its disaster as affecting beef animals is definitely recognized by large packers, and that likewise its prevalence among dairy animals is pretty generally known by the milk consuming public. This knowledge among the packers has its serious influence on the market price of beef animals, affecting both the producer and the consumer.

In the case of milk we can never expect it to come into its own until it is produced above suspicion, the same as we exact in the production and preparation of other wholesome articles that may carry contamination, such as soups, vegetables, cereals, etc. Our equipment must be so that we may court inspection of our methods the same as do the producers of the commodities just mentioned. This will require that milk be produced in sanitary surroundings, by healthy animals, and handled with scrupulous cleanliness by clean, healthy people. This should be followed by a national campaign extolling the nutritive and digestive merits of milk and its just value both from cost of production and food value; under such rightful conditions the consumption of milk at equitable cost would tax our present possible supply.

We have discussed the nature of tuberculosis and the best methods known today to detect its presence in the animal body. We have reviewed the limitations of tuberculin, and after all has been said and deductions made, by far the better way to deal with tuberculosis is to shun it as a thief in the night. To those whose herds are already infected we recommend the methods outlined under diagnosis and control. To those who are about to enter the cattle industry we urge by all means that they select their foundation stock from certified herds where the records show freedom from tuberculosis for at least several years.

Do not rely on the glib assurance of some sharper that his cattle are free from tuberculosis. After a satisfactory nucleus has been secured, be patient and be content to build up a herd, avoiding the danger of undoing all that has been done by a desire to add some particular strain or individual to the herd. If it is desirable to do this, do it by purchasing a sire and keep him separate from the rest of the herd at all times other than at the time of service. If for any reason additional females must be added provide a rigid quarantine and hold such animals there until they have passed at least two satisfactory tuberculin tests; one of these to be a spring test.

The following principles are declared for guidance of federal inspectors in passing on carcasses affected with tuberculosis:

Principle A.—No meat should be used for food if it contains tubercle bacilli, or if there is a reasonable possibility that it may contain tubercle bacilli, or if it is impregnated with toxic substance of tuberculosis or associated septic infections.

Principle B.—Meat should not be destroyed if the lesions are localized and not numerous, if there is no evidence of distribution of tubercle bacilli through the blood or by other means to the muscles or to parts that may be eaten with the muscles, and if the animal is well nourished and in good condition, since in this case there is no proof, or even reason to suspect, that the flesh is unwholesome.

Principle C.—Evidences of generalized tuberculosis are to be sought in such distribution and number of tuberculous lesions as can be explained only upon the supposition of the entrance of tubercle bacilli in considerable number into the systemic circulation. Significant of such generalization is the presence of numerous uniformly distributed tubercles throughout both lungs, also tubercles in the spleen, kidneys, bones, joints, and sexual glands, and in the lymph glands connected with these organs and parts, or in the splenic, renal, prescapular, popliteal and inguinal glands, when several of these organs and parts are coincidentally affected.

Principle D.—Localized tuberculosis is tuberculosis limited to a single or several parts or organs of the body without evidence of recent invasion of numerous bacilli into the systemic circulation.

The meat of animals affected with tuberculosis should be disposed of as follows:

Rule A.—The entire carcass shall be condemned if any of the following conditions occur:

(*a*) When it was observed before the animal was killed that it was suffering with fever.

(*b*) When there is a tuberculous or other cachexia, as shown by anemia and emaciation.

(*c*) When the lesions of tuberculosis are generalized, as shown by their presence not only at the usual seats of primary infection but also in parts of the carcass or in the organs that may be reached by the bacilli of tuberculosis only when they are carried in the systemic circulation. Tuberculosis lesions in any two of the following mentioned organs are to be accepted as evidence of generalization when they occur in addition to local tuberculosis lesions in the digestive or respiratory tracts, including the lymph glands connected therewith: Spleen, kidney, uterus, udder, ovary, testicle, adrenal gland, and brain or spinal cord or their membranes. Numerous tubercles uniformly distributed throughout both lungs also afford evidence of generalization.

(*d*) When the lesions of tuberculosis are found in the muscles or intermuscular tissue or bones or joints, or in the body lymph glands as a result of draining the muscles, bones or joints.

(*e*) When the lesions are extensive in one or both body cavities.

(*f*) When the lesions are multiple, acute, and actively progressive. (Evidence of active progress consists in signs of acute inflammation about the lesions, or liquefaction necrosis, or the presence of young tubercles.)

Rule B.—An organ or a part of a carcass shall be condemned under any of the following conditions:

(*a*) When it contains lesions of tuberculosis.

(*b*) When the lesion is localized but immediately adjacent to the flesh, as in the case of tuberculosis of the parietal pleura or peritoneum. In this case not only the membrane or part affected but also the adjacent thoracic or abdominal wall is to be condemned.

(*c*) When it has been contaminated by tuberculous material through contact with the floor or a soiled knife or otherwise.

(*d*) Heads showing lesions of tuberculosis shall be condemned, except that when the heads of hogs are from carcasses passed for food or for sterilization and the lesions are slight, are calcified or encapsulated, and are confined to lymph glands in which not more than two glands are involved, the head may be passed for sterilization after the diseased tissues have been removed and condemned.

(*e*) An organ shall be condemned when the corresponding lymph gland is tuberculous.

Rule C.—Carcasses showing lesions of tuberculosis should be passed for food when the lesions are slight, localized and calcified or encapsulated, or are limited to a single or several parts or organs of the body (except as noted in Rule A), and there is no evidence of recent invasion of tubercle bacilli into the systemic circulation. Under this rule carcasses showing such lesions are removed and condemned in accordance with Rule B:

(*a*) In the cervical lymph glands and two groups of visceral lymph glands in a single body cavity, such as the cervical, bronchial, and mediastinal glands, or the cervical, hepatic, and mesenteric glands.

(*b*) In the cervical lymph glands and one group of visceral lymph glands and one organ in a single body cavity, such as the cervical and bronchial glands and the lungs, or the cervical and hepatic glands and the liver.

(*c*) In two troups of visceral lymph glands and one organ in a single body cavity, such as the bronchial and mediastinal glands and the lungs, or the hepatic and mesenteric glands and the liver.

(*d*) In two groups of visceral lymph glands in the thoracic cavity and one group in the abdominal cavity, or in one group of visceral lymph glands in the thoracic cavity and two groups in the abdominal cavity, such as the bronchial, mediastinal, and hepatic glands, or the bronchial, hepatic, and mesenteric glands.

(*e*) In the cervical lymph glands and one group of visceral lymph glands in each body cavity, such as the cervical, bronchial, and hepatic glands.

(*f*) In the cervical lymph glands and one group of visceral lymph glands in each body cavity, together with the liver when the latter contains but few localized foci. In this class of carcasses, which will be chiefly those of hogs, the lesions of the liver are considered to be primary, as the disease is practically always of alimentary origin.

Rule D.—Carcasses which reveal lesions more severe or more numerous than those described for carcasses to be passed (Rule C), but not so severe nor so numerous as the lesions described for carcasses to be condemned (Rule A), may be rendered into lard or tallow or otherwise sterilized in accordance with Regulation 15, if the distribution of the lesions is such that all parts containing tuberculous lesions can be removed.

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II

THE INTRADERMAL TEST

By D. F. LUCKEY

In the discussion of any form of the tuberculin test, certain fundamental principles must be kept in mind. In all work of human hands there is bound to be a certain percentage of errors. The tuberculin test has heretofore been given the credit of being accurate almost to the point of infallibility. While past experience indicates that, properly used, the tuberculin test is exceedingly accurate, it must be admitted that it is far from infallible. In the hands of the inexperienced or careless, its use is of doubtful value. No matter in what form the tuberculin test is used, a certain number of errors will be made. It is, therefore, important, in the discussion of this test, to consider some of the important factors leading to errors.

Some healthy animals are susceptible to the tuberculin test. That is, an individual cow raised in a healthy herd, with no probability whatever of tuberculosis infection, will, now and then, react to any form of the tuberculin test. Such a cow may give a typical reaction and, when sent to slaughter, show no lesions. The entire herd from which she came may be tested annually, before and after, without showing any reactors. It is safe to say that, in general, about one in every five thousand healthy cows will react to the tuberculin test.

It is a well known fact that some tuberculous animals are immune to any form of the tuberculin test. Some such animals will react to one test when they will not react to another. It has been acknowledged, heretofore, that an animal in the advanced stages of tuberculosis may not react to the tuberculin test. It must now be admitted that, in rare cases, a tuberculous animal will fail to react when not in the advanced stages of the disease. These cases no doubt are rare but, to some extent, contribute to the errors.

As has been intimated, an animal may be immune to one test and still react to another. We have known of individual cases where a tuberculous cow would repeatedly fail to react to the temperature test and would subsequently show a clear-cut reaction to the intradermal test, and vice versa. It is highly probable that an individual now and then may fail to react to both the subcutaneous and the intradermal test and still show a reaction to the ophthalmic test.

Furthermore, the susceptibility to any test varies greatly in different animals in the same herd. In some herds the tuberculous cattle will show degrees of reactions from the extremely well-marked to practically nothing, regardless of whether the subcutaneous, the intradermal, or the ophthalmic test is used. In the use of the subcutaneous test it has long been observed that the rise of temperature in tuberculous animals may vary from five degrees down to a fraction of one degree. We have found a yearling in which the highest post-injection temperature was only nine-tenths of one degree above the highest pre-injection temperature. The variation in the temperature was not sufficient even to mark the animal as suspicious. Yet it was condemned and, when slaughtered, showed well developed lesions of tuberculosis. The same rule applies when the intradermal or the ophthalmic test is used. The swelling in reacting animals may vary from well-marked lumps as large as a hen egg down to an enlargement the size of the half of a pea. In the ophthalmic test, the eye in one animal may be so inflamed as to present a pitiful sight while in another animal in the same herd a mere drop of mucopurulent material may be found so small as to escape observation unless the eye is frequently examined. These subdued reactions occur in one or more tuberculous animals in a large majority of tuberculous herds, and the animals are commonly classed as ''suspects.''

In a minority of the tuberculous herds every diseased animal will show a clear-cut reaction to any test administered and every healthy animal will show positively no reaction whatever.

These ''suspects'' present the puzzle of tuberculin testing. They are the bane of the veterinarian who is anxious to accomplish accurate results. A slight or suspicious reaction is no indication that the animal is in the advanced stages of tuberculosis. These suspicious reactions are found with extreme frequency in animals which on postmortem show very slight lesions. If we condemn promiscuously we are sure to have a large percentage of condemned animals showing no lesions. If we pass them for sound, we are almost certain to fail to get the herd in a sound condition. Except for these "suspects," the tuberculin test would be a very simple and pleasant matter.

The technic of the various forms of tuberculin testing is not at all difficult. At first glance it seems so simple that any person of average intelligence might apply it. The apparent simplicity of the various forms of tuberculin testing often tempts agricultural students, dairymen and breeders to undertake the work. *Any student can easily master the technic of the test, but he cannot master the test itself.* In fact, there are very few people who are able to apply the tuberculin test in such a practical way as to completely eradicate tuberculosis in dairy districts when it has once become widespread.

The literature of the past has, in most cases, exaggerated the accuracy of the test. The veterinarians have had to convince skeptical breeders. They have, to some extent, overdone the matter and have come dangerously near causing both breeders and themselves to become over-confident of its accuracy.

To test dairy and breeding herds, taking them as they come, large and small, healthy and diseased, and to leave them all in a sound condition, would require superhuman wisdom. It is an easy matter to pass over the sound herds. With due care those herds in which a small percentage of reactors are found may, in due time, be left in a sound condition. When the herd shows a high percentage of reactors, and especially if the owner is careless and the sanitary conditions are bad, it is practically impossible to get such a herd in a sound condition.

Failure, however, even in such extreme cases, is not due to any fault of the tuberculin test.

Veterinarians, like all other people, are possessed of a certain amount of human carelessness. I have had temperature tests turned in to my office by competent graduate veterinarians which showed only two post-injection temperatures. Many records of the intradermal test received here indicate that the reëxamination was made within twenty-four hours after the injection. A large percentage of the tuberculin test records covering the interstate shipment of cattle show plain evidence of the rankest kind of carelessness. Undoubtedly carelessness is responsible for a certain percentage of the errors made in testing cattle for tuberculosis.

We find that veterinarians are too prone to apply the tuberculin test by rule. This is especially true of recent graduates from the average veterinary college. Almost, without exception, they take two or three pre-injection temperatures as a matter of form. At some convenient hour the tuberculin is injected under the skin. When other business does not interfere, some four temperatures are taken, often beginning the tenth or eleventh hour after the injection of tuberculin. Finally the rule is applied. If the operator is from a college where they teach that a rise of three degrees indicates that the animal is tuberculous, he applies the rule of three degrees. If he happens to be from a college where they teach that a rise of two degrees indicates that the animal is tuberculous, he applies the rule of two degrees, makes out the temperature chart and pronounces the test finished. Too many veterinarians take it for granted that they understand the simple technic of the tuberculin test when they do not. To this again a certain percentage of errors may be attributed.

What is classed by Dr. Wills, of New York, as ''delayed'' reactions contribute somewhat to the errors of the tuberculin test. He has found that individual animals, now and then, show the rise in temperature twenty-four, forty-eight, or even seventy-two hours after the injection of tuberculin. We have found in this state that, very frequently indeed, the temperature reaction comes on twenty-four hours after the injection, especially on making retests. The man who quits taking post-injection temperatures at the twentieth or twenty-second hour after the injection of tuberculin will miss a very small percentage of the reactors when the cattle are being tested for the first time. If the cattle are being put through a retest, he is certain to miss a large percentage of the reactors.

In all cases where a retest is being made with the subcutaneous method, the dose of tuberculin should be doubled, the taking of post-injection temperatures should be begun not later than the sixth hour and reactions may be looked for at any time up to the twenty-fourth hour. A large percentage of them will occur at the twenty-fourth hour and a reaction, now and then, will come later. Overlooking this important matter doubtless contributes somewhat to the errors recorded against the tuberculin test.

The most abominable factor contributing to errors in the tuberculin test lies in the willful disposition of owners of tuberculous herds to ‘‘plug’’ diseased cattle to make them pass as sound, or, when the subcutaneous test is being used, to administer with the feed certain agents to prevent a rise of temperature. Fortunately, this element does not count in the general tuberculin testing in the West. This vicious practice is found only among a few owners of badly tuberculous herds. However, it may, in some cases, contribute to the errors which are charged to the tuberculin test.

The beginner briefly surveys the technic of the tuberculin test and is too prone to consider himself its master. He is likely to begin this work with the utmost confidence that he will draw an infallible line between the diseased and healthy cattle and that all those which he condemns will show an abundance of lesions. As he proceeds, his over-confidence fades. After a year or so of actual and continual practice, he begins to come to himself. At the end of some ten years, he may, if he is wise, come to a rather full realization that the tuberculin test is not only the most sacred work falling to the hands of veterinarians but that it is the most intricate and complex. There are very, very few artificers administering the tuberculin test. Considering the number of novices, who, in the past, have been permitted to apply it, it is wonderful that the tuberculin test has survived. However, combining good judgment, care and skill with the hearty and intelligent coöperation of the owners of all the dairy and breeding herds in any community, tuberculosis can certainly be entirely eliminated. It might be economical, in rare cases where fifty per cent or more of the cattle are diseased, the owner careless and the sanitary conditions bad, to have the whole herd destroyed.

With all of these complicating details in view, we can enter upon a discussion of the intradermal test and fairly judge its accuracy.

Extent of the Use of the Intradermal Test

We have used the intradermal test almost exclusively in our state work during the past six years. We have made over 100,000 tests. As some of the herds tested by this method have gone through the test two or even three times, we have not tested quite 100,000 different cattle. All of the reacting animals have been condemned and sent to slaughter. In certain dairy districts, those which were passed for sound have undergone one, two, or even three retests. In short, the intradermal method has been put on severe trial. During these years, this test has been used principally on the permanent herds to remain in the state. At the same time, the temperature test has been applied in making inspections for interstate shipment. In the tests of some of our permanent herds, we have interchanged the tests, even combining the ophthalmic test with them. We have given all these tests a thorough trial under the same identical conditions. From the very beginning, the intradermal method has produced the most satisfactory results. Apparently, this method of testing cattle for tuberculosis has rapidly gained favor wherever it has been used.

Kind of Tuberculin

In all of our official tests, regardless of the method used, we have used the tuberculin furnished by the Federal Bureau of Animal Industry. No commercial tuberculin nor any special preparation has ever been used on any of the cattle counted in our records. We cannot speak from experience as to the merits of any other kind of tuberculin.

Kind of Syringe

There are two important essentials to look out for in a syringe for applying the intradermal test. The plunger should fit the barrel well so that it will stand pressure without leaking. The handle of the syringe should be round and smooth so that it will not hurt the hand when administering the pressure necessary to drive the tuberculin into the skin. The size of the syringe is of no importance whatever. In the beginning of this test we were inclined to run to the use of a two or three mil. syringe. I have used all sizes and types of syringes and am now using a regular 20-cc. size with a good plunger and a knob handle on the piston.

Kind of Needle

It is hardly possible to advise the right type of needle to use in making the intradermal test. It is fairly safe to say that the average operator will find the twenty-two gauge, three-sixteenth inch dental needle the most satisfactory. The smaller gauged dental needles are easily broken and are inclined to become plugged. Theoretically, the larger gauge needles may provide openings large enough for the introduction of infection. It is safe to advise the beginner to use the twenty-two gauge, three-sixteenth inch needle of the type used by dentists in applying anesthetics.

However, this conclusion is based more upon convenience than actual results. The fact is that during 1911 we used the large needle, such as was then used in ordinary veterinary practice and is now used in hog cholera vaccination. With this coarse needle we produced a better record, both as to post-mortem results and leaving the tested herds sound, than we have ever been able to do with any other kind of a needle or any other kind of a test. We have drifted to the use of the small dental needle, not because it has produced more accurate results but because it is more convenient and more nearly fool-proof. It is barely possible that we will find that the coarse needle produces the best results. In addition to our good post-mortem record with the large needle, we did not have nearly as large a percentage of ''suspects.'' We usually got a clear-cut reaction or none at all. Subsequent yearly retests of a large number of herds on which the large needle was used showed the sound herds still sound and that diseased herds had been cleaned up to a wonderful degree of accuracy. We are not sure but what the large needle will gain in popularity. The matter should certainly be carefully investigated.

Where to Make the Injection

Undoubtedly the most convenient place is the bare part on the inferior surface of the tail. The injection may be made in the caudal fold or farther back, according to the preference of the operator. It is my belief that the most accurate results can be obtained by making the injection as far down on the tail as the soft, bare skin can be found. The injection of one caudal fold affords a chance of comparison and is useful when onlookers are to be convinced of the presence of a reaction. The objection to this point is that the swelling may be diffused and, therefore, difficult to observe.

The injection may be made into the skin on the lower eyelid. Our limited experience with this point of injection indicates that it is not so convenient and the reactions are not so distinct.

The injection may be made in any other place upon the body, but will require the additional trouble of shaving the skin. Wherever the skin is hard the injection is difficult. The beginner will undoubtedly make the best progress with the intradermal test by applying it to the under surface of the tail.

How to Make the Injection

The essential point is to be careful not to run the needle through the skin but simply into it, far enough so that the tuberculin will not ooze out through the surface. The position assumed by the operator does not matter at all. We find it fairly convenient to stand squarely behind the animal and grasp the tail, pinching up any of the soft skin between the thumb and fingers. By pinching the skin just a little the animal scarcely notices the pain caused by the insertion of the needle, especially when the small needle is used. After the insertion of the needle, pressure is applied to the plunger sufficient to drive enough of the tuberculin into the skin to produce a small elevation visible to the eye and easily felt with the fingers. An effort should be made to produce an elevation the size of an ordinary navy bean or a little larger.

Disinfection of the Site of Injection

Do not attempt to disinfect the site of injection. When from any cause the skin is saturated with moisture, you are apt to get a swelling in a healthy animal. If the skin is soiled with feces, simply wipe it off, preferably with is soiled with feces, simply wipe it, preferably with a cloth or with absorbent cotton than to wash it with water and further moisten it. Under no conditions should liquid antiseptics be applied to the site of the injection.

The Dose

We have never found any syringe with which we could accurately measure the dose which should be given in administering the intradermal test. The object is to produce a lump in the skin. As a rule, the skillful operator will average two and one-half to three drops for each cow. In individual animals with a hard skin, it is difficult to inject more than one drop. In the loose, soft-skinned cow, it does not require much pressure on the syringe to inject five or even ten drops. It is impossible to accurately regulate the dose by any method whatsoever. The operator will simply have to practice on producing a well-marked lump from the injection of the tuberculin. In all probability, a good reaction will result from the use of one drop, but it is better to try to make such enlargements as will require the use of two and one-half to three drops.

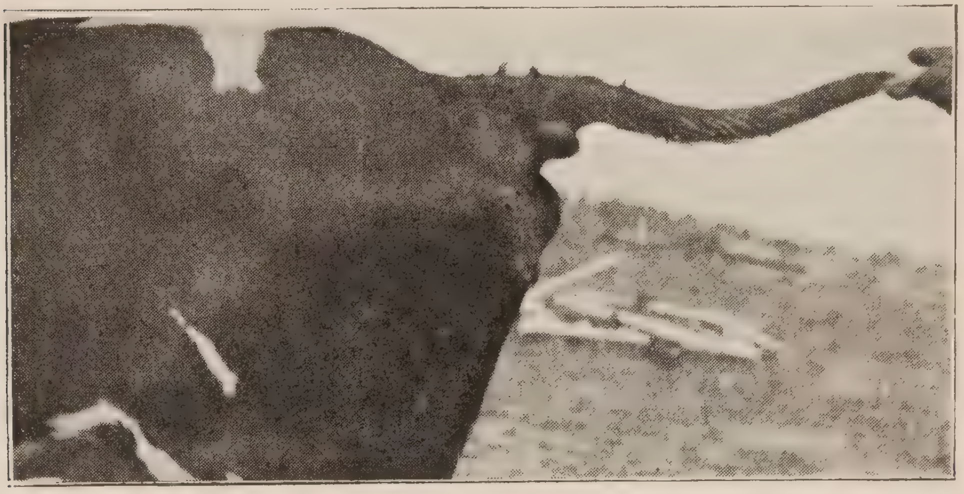
When to Observe the Reaction

The average swelling will be at its height at about the seventy-second hour. If the animal is to be reëxamined only once, it should be done about the seventy-second hour, and not sooner than the sixtieth nor later than the eightieth.

In rare cases, the swelling may come and go before the seventy-second hour. In one herd where forty-six animals were condemned, the cattle were observed on the second, third and fourth days. Four reactions were discovered on the fourth day, or ninety-six hours after injection, which were not visible on the third day. Therefore, there is no absolute set rule as to the time to reëxamine the cattle. For the ordinary run of dairy herd testing, it is safe to make the reëxamination at the seventy-second hour. This is true only when herds containing reactors are to be retested in about ninety days. In testing high-priced herds, the operator should, by all means, carefully examine all of the cattle on the second, third and fourth days. As in some cases we get a temperature reaction also, it would not be out of place to take a few temperatures between the ninth and twentieth hours after the injection.

How to Observe the Reaction

Every animal should be caught and the point of injection should be carefully examined with the bare fingers. The running of a herd of cattle through a gate and trying to observe the point of injection as they are passing amounts to almost criminal carelessness. Such a test is practically worthless. The examination cannot be too carefully made. In this, as in all other matters pertaining to any form of the tuberculin test, absolute thoroughness should be practiced.



Photographed by Dr. H. Welch, Montana.

FIG. 4. AN UNUSUALLY WELL DEFINED REACTION TO THE INTRADERMAL TUBERCULIN TEST.

Type of Reaction

No definite rule or measure can be laid down to govern the decision on the results of the intradermal test. Like other tuberculin tests, the art of deciding upon reactions can be learned only by actual practice. It is never learned unless the operator has natural ability for this line of work and carefully applies his intelligence. The swellings vary in size from a half of a hen egg, or larger, down to the size of half a pea. This is true in a large percentage (probably in the majority) of herds containing diseased animals. Some of these swellings will be round and prominent, even though they are small. Some will become diffused and encircle the tail. In one case, I found the tail swollen to its end.

In a general way, the reaction to the intradermal test is best marked at about the seventy-second hour. As a rule, the swelling varies in size, being fairly well circumscribed, hard, hot and sensitive. The outstanding characteristic of a reaction to the intradermal test is the length of time the swelling persists. A soft, puffy swelling nearly always follows the injection of tuberculin as the result of irritation. These swellings which are not the result of a tuberculin reaction usually disappear within forty-eight hours. The swelling from the reaction comes on slower and the most important point of all is that it persists longer. It often remains four or five days, or even ten days. Frequently, small gangrenous patches and black scabs form on the swelling. This is another strong indication that the animal is tuberculous, regardless of the size of the swelling.

Accuracy of the Intradermal Test

The accuracy of any test is judged from two standpoints. First, the test must leave the herds clean and free from tuberculosis. This is the matter of first and greatest importance and should be kept in mind above all things else. Second, a fairly good percentage of the cattle condemned and killed should show lesions of tuberculosis on postmortem. This is an important factor when dealing with high-priced registered cattle but amounts to practically nothing in the ordinary run of testing dairy herds where the value of the average dairy cow is to be weighed up against the lives of many children.

During the six years that the intradermal test has been officially used in Missouri, we have made a better record with it from all standpoints than we have ever been able to make with the subcutaneous or any other method. In general, we have found that it has been more successful in ridding diseased herds of tuberculosis than the subcutaneous test and only in two years, 1915 and 1916, has it failed to produce a better postmortem record.

The following is taken from my annual report of January 12, 1914, and applies to the official use of the intradermal test in this state for over three years.

''One of the most gratifying features of this work is that a retest of the dairy cattle around different cities has shown that our work was thorough and effective. In our retest for Sedalia, Missouri, we did not find a single tuberculous cow. A retest around Hannibal, Missouri, after a lapse of three years, revealed the presence of one tuberculous cow. Retests around Columbia, wherever such retests appeared necessary, showed no tuberculous cattle except in one dairy, and the infection was introduced into this herd since our last test. Retests around St. Joseph after a lapse of two years, as far as they have gone, show practically no tuberculous cattle. These results are especially gratifying.''

During the year 1911, the test just coming into use, we used extreme caution in applying it. We sent 103 cattle condemned by this method to slaughter, of which 101, or 98 per cent, showed lesions. We made a perfect score on leaving the tested herds sound. In 1914 we tested 18,553 cattle with the intradermal test. We condemned 365 head. At the time the annual report of 1914 was published, we had sent to slaughter 327 head, of which 307 or 93.9 per cent showed lesions. Of the twenty head which showed no lesions, nine were condemned on a ninety-day retest and were supposed to have been in the incipient stages of tuberculosis. Quite a number of inexperienced men engaged in making these tests and seven of these errors are attributable to tests made by inexperienced operators. One animal of those which showed no lesions was condemned upon its general appearance instead of the reaction and, while it did not show tuberculosis on post-mortem, it was condemned for emaciation.

Photographed by Dr. H. Welch, Montana.

FIG. 5. RANGE HERD OF HIGH GRADE HEREFORDS.

Five out of 358 animals in the herd reacted positively to the intradermal test.

When all of these matters were carefuly gone into, we found that we could justly be charged with only three errors and that our accuracy should have shown over 99 per cent. Having established the fact, beyond question of doubt, that the intradermal test was sufficiently accurate to be relied upon, we henceforth made no special effort to make a good post-mortem showing. Our principal object has been to clean the tuberculous animals out of all the herds which we tested.

During the year 1915, with no special effort to make a good post-mortem showing with either test, we made a good comparative record of the intradermal with the subcutaneous test. With the intradermal test we condemned 685 head of cattle. At the time the annual report for the year was published, 645 head had been sent to slaughter, of which 569, or 88.2 per cent, showed lesions. With the subcutaneous test, we condemned 123 head of cattle. At the time the annual report was published, 99 had been sent to slaughter, of which 88, or 88.9 per cent, showed lesions. Furthermore, the subcutaneous test was used almost exclusivley on cattle tested for interstate shipment and, therefore, with greater care, especially on the high-priced registered animals. The intradermal test, in a large part, was used on grade herds with no especial desire to make a post-mortem record but we tried to leave the herds in a sound condition.

During the year 1916 we tested 37,660 head of cattle with the intradermal test, of which we condemned 802 head. ''Suspects'' were given very little consideration. Candidly, we may have gone a little to the extreme in condemning animals that might ordinarily be classed as ''suspects.'' We were determined to leave the herds sound and to protect the public from any possibility of the use of tuberculous milk. At the end of the year, 798 head of the condemned cattle had been sent to slaughter, of which 674, or 85 per cent, showed lesions of tuberculosis. During this year we condemned 285 head (mostly high-priced, registered cattle) with the subcutaneous test. At the end of the year, 242 had been sent to slaughter, of which 223, or 92 per cent, showed lesions.

It is fairly safe to say that, taking the tuberculin test as it is generally employed in large herds, small herds, wild and excitable cattle, the intradermal is at least as accurate, if not more accurate, than the subcutaneous method.

Convenience

From the standpoint of convenience, there is no comparison between the intradermal and the subcutaneous methods. The intradermal method can be applied to any animal that can be held still for a small fraction of a minute. The operator can start out in the morning and inject and tag herd after herd, all the day long. When night comes he can go to bed and enjoy a good rest. He can repeat the operation the next day and the next. On the third day he can retrace his course of the first day and examine all the cattle injected and finish this in time to make up his records, and so on from day to day. Altogether, he can do about three times as much work with this test.

The worry of the cattle, a big item with dairymen, cuts practically no figure in the administration of the intradermal test. If the herd is properly handled, each individual animal is put to a little annoyance for about one minute. When the test is made and the operator is out of the way, the dairyman can go ahead with his work.

Photographed by Dr. H. Welch, Montana.

FIG. 6. RANGE HERD OF SPAYED HEIFERS.

Sixty-six animals in this herd reacted positively to the intradermal test.

Neither the disposition nor the condition of the animal affects the test. Whether the animal be docile or wild, the results are the same. The age of the animal cuts no figure. The intradermal test may be applied to calves three weeks old and upward. Advanced pregnancy, recent parturition, hot weather, and many other factors which interfere with the accuracy of the subcutaneous test, have little or no bearing upon the results gotten by the intradermal method. Considered from the standpoint of convenience alone, there is no place left for the use of the subcutaneous test.

Interchange of Tests

There are many conditions where the methods of tuberculin tests should undoubtedly be used alternately. One condition is in the diseased herd from which any one method used alone fails to eliminate all the tuberculous animals and reactors are found on subsequent tests. If the subcutaneous or ophthalmic test has been in use and has been missing some diseased animals, the intradermal test will often serve to pick them out. When a health certificate covering a shipment of cattle coming from one of the old dairy districts shows that some have been rejected and that the remainder of the shipment has been more or less exposed, a retest at destination within ninety days is indicated. In these retests, the intradermal method is especially valuable.

We have found it a good practice to use the intradermal method in testing herds the first time. In making a retest ninety days later on herds from which diseased animals have been removed, the subcutaneous test may be used, or a combination of the subcutaneous and the ophthalmic tests. In certain cases where herds are being tested annually, it is advisable to alternate the intradermal and the subcutaneous tests. This is not necessary when the herd regularly tests sound. When reactors are found from time to time, this interchange is especially desirable. It is also desirable to alternate these two tests in herds which are producing certified milk, or which are producing milk especially for children or for hospitals. This alternation of the test simply adds a little to the certainty of good results. In cases where herds are tested oftener than once a year and the cattle thereby partly lose their susceptibility to the test, it is imperative that the methods be alternated.

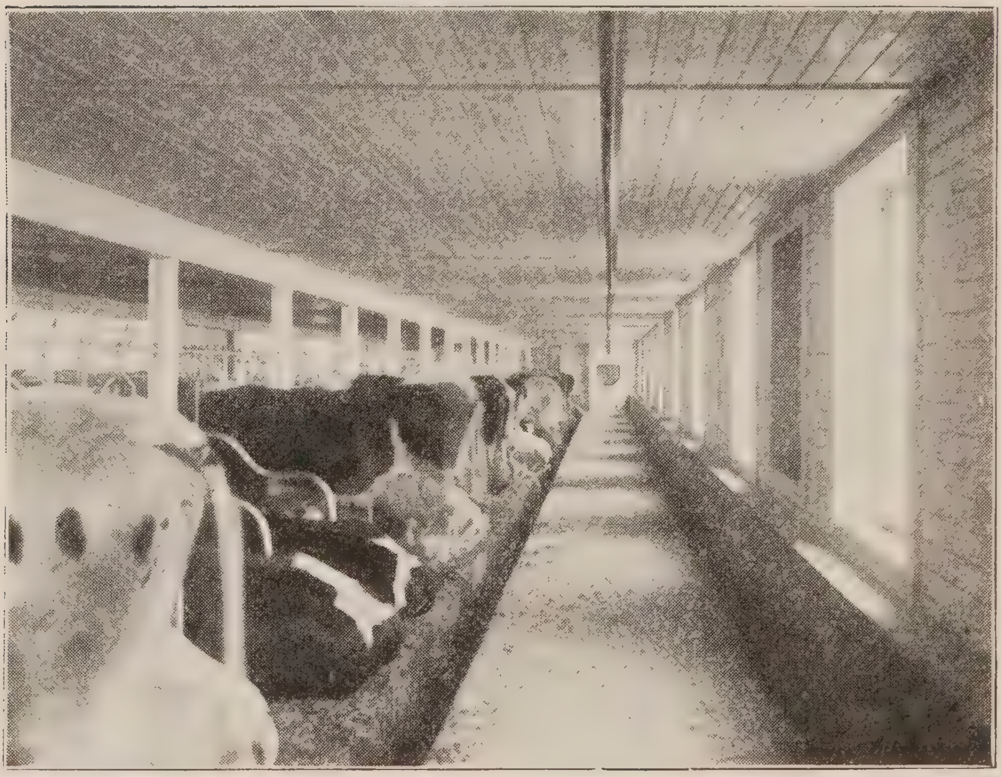


FIG. 7. AN INEXPENSIVE DAIRY BARN THAT MEETS SANITARY REQUIREMENTS FAIRLY WELL

Note the metal stanchions, abundant light, manure carrier and the deep trough at the proper distance from the stanchions to keep the cows clean.

III

THE STATE ACCREDITED HERD

By O. E. DYSON

Practically every effort made throughout the United States to eradicate or control bovine tuberculosis, and incidentally tuberculosis in swine, has been doomed to failure in advance, principally for the reason that up to this time no way or means has been provided whereby the owner of an infected herd could escape an inevitable loss, generally amounting to at least one-third of the actual value of all cattle reacting to the tuberculin test. In many instances, owing to restrictions under which cattle are appraised in various states, the losses would be greatly in excess of one-third of their appraised value. Consequently, a large majority of cattle breeders have preferred to contend with the ravages of tuberculosis rather than to face uncertainty as to the economic loss they would be called upon to sustain in order to clean up their herds. This condition has been largely brought about through efforts made by state live-stock sanitary officials to control bovine tuberculosis by the appraisement and slaughter of all cattle which react to the tuberculin test.

In addition to the economic losses attending the slaughter of reactors, owners are confronted with the fact that it is practically impossible to eradicate tuberculosis by subjecting the herd to a single tuberculin test and removing reactors. Furthermore, owners have had little or no assurance of being able to replace reactors removed from their herds with cattle equally as good that are free from tuberculosis or exposure thereto, at the time of purchase. Under these conditions there has been but little incentive on the part of breeders to establish and maintain cattle herds free from tuberculosis. This condition will prevail so long as the sale and delivery of cattle for breeding or dairy purposes can be made without regard to whether or not they are affected with tuberculosis. Traffic in tuberculous cattle is a common practice and contributes to the unrestricted spread of the disease.

The tuberculin test is the only means whereby it is possible to determine whether or not a herd is free from tuberculosis. In purchasing cattle from an infected herd, ordinarily the risk of procuring infected cattle is greatly in excess of the percentage of reactors in the herd. Certificates of health covering the tuberculin testing of one or several animals in a herd give the purchaser absolutely no clue as to the percentage of tuberculous cattle in the herd. The value of all certificates of health should be based primarily upon the percentage of reactors in the herd from which a purchase is made. A certificate of health, in order to afford protection to the purchaser, should be worth its face value. Cattle breeders and sales managers do not accept ''checks'' of doubtful value in payment for cattle purchased; consequently, purchasers should insist that certificates of health covering the cattle purchased be placed upon a par with ''certified checks.''

At present, except in dealing with discriminating buyers, owners of tuberculosis-free herds are required to compete on equal terms with the owners of infected herds. Under these conditions there is absolutely no hope of progress being made toward the control of bovine tuberculosis.

The Remedy

Laws should be enacted providing means whereby owners of tuberculous herds may be compensated to the amount of one-third of the appraised value of all cattle reacting to tuberculin tests conducted upon the request of the owner, provided all of the cattle in the herd are included in the test. In addition to receiving one-third of the appraised value of reactors, the owner should have the option of segregating such cattle and being permitted to utilize the same for breeding or dairy purposes *under official quarantine and regulations insuring protection to the live-stock interests and to public health.*

Laws should be enacted prohibiting the sale or delivery of pure-bred cattle into or within any state except from state accredited herds or from herds wherein all of the cattle have been subjected to the tuberculin test within ninety days previous to the date of sale or delivery. All certificates of health should be executed in such a manner as to plainly show the percentage of reactors in the herd from which sales are made. The record of herds tested should be embodied in catalogues covering cattle to be sold at public sale and should be publicly announced by the auctioneer at the time of offering the animals for sale at public auction.

Conclusions

All cattle removed from infected herds when offered for sale should be sold as having been ''exposed'' to infection. Bovine tuberculosis can never be eradicated or controlled or the pure-bred cattle breeding business placed upon a sound and equitable basis until the purchasers of breeding stock are afforded the same protection that is afforded the public in general against deception and fraudulent practice, now so commonly utilized for the purpose of disposing of tuberculous cattle in competition and upon equal terms with cattle free from disease. There is positively no reason why clean herds and tuberculous herds should not be made as distinct in classification as cattle typically representing the various breeds.

The compulsory slaughter of all cattle which react to the tuberculin test (except such cattle as show clinical evidence of tuberculosis) constitutes an uncalled for economic waste. By segregating such cattle and utilizing them for breeding or dairy purposes under strict quarantine, every practical purpose can be served and the progeny of such herds can be utilized for the building and upkeep of healthy herds. In fact, the eradication of tuberculosis from pure-bred cattle herds can be permanently and profitably accomplished by the average owner under the proposed plan. The establishment of state accredited herds will ultimately solve the problem of dealing with bovine tuberculosis in a manner that will prove satisfactory to all concerned.

For the protection of the live-stock interests throughout the United States there should be full coöperation on the part of the federal government and the various states. The eradication or control of bovine tuberculosis, contagious abortion and hog cholera is of as much importance to the future welfare of the live-stock producing interests and the country at large as was the eradication of foot-and-mouth disease, and in my opinion any one of the above mentioned diseases can be more easily controlled than foot-and-mouth disease. The success of any effort to control, however, must be based primarily upon the economic factors involved, coupled with the enactment and enforcement of state and federal laws restricting the sale or shipment of cattle for purposes other than slaughter, except from herds known to be free from tuberculosis and contagious abortion. The control of hog cholera, also, largely if not entirely, depends upon restricting the movement of cholera-infected hogs, quarantine and treatment by the administration of serum and virus to infected lots and a thorough disinfection of infected premises.

While the foregoing statements may be looked upon by many as an optimistic dream, they are without a doubt within the range of practical application of modern live-stock sanitary control. Ignorance and greed, coupled with the unrestricted privilege now enjoyed by owners of and dealers in cattle affected with tuberculosis and contagious abortion, are responsible for the wide distribution and the continued spread of these diseases, and unless active and effective steps are soon taken to curb the activities of those directly responsible for this condition live stock producers will be forced to contend with such handicaps as prohibited interstate movement of cattle and hogs except for immediate slaughter, restricted markets for dairy products, and non-productive herds, which will ultimately render live-stock production a hazardous undertaking. If a small portion of the economic losses now annually sustained by live-stock producers on account of tuberculosis, contagious abortion and hog cholera could be expended for the purpose of efficient live-stock sanitary control, the losses resulting from these diseases could be reduced fifty per cent within a period of two years, and within ten years they could be controlled to such a degree that they would no longer serve as a menace to the safe and profitable production of cattle and hogs by the average breeder.

For many years I have been convinced that the control of bovine tuberculosis was a state and federal problem. This is occasioned by the fact that there is a constant interchange of cattle between the various states, and up to this time it has not been possible for a single state to prevent the importation or exportation of cattle which have been exposed to infection through having been in contact with infected herds and premises. Consequently, inasmuch as the tuberculin test cannot be relied upon to detect exposed animals or cattle which have become infected as a result of having been exposed and then have been subjected to the tuberculin test during the incubation period, which invariably intervenes between exposure and detectable development of the disease, there is no way whereby state live-stock sanitary authorities can prevent the importation or exportation of infected cattle, so long as cattle which have been exposed to a tuberculous infection through direct contact with infected herds are permitted unrestricted sale and shipment. Furthermore, it is economically prohibitive for many states to undertake to compensate owners for losses sustained through efforts to eradicate the disease. If the federal government, however, could be induced to coöperate with the various states to the extent of bearing one-half of the expense incurred in the eradication or control of bovine tuberculosis, great progress could soon be made. The successful control of foot-and-mouth disease through coöperation of state and federal forces can be cited as a precedent for the claim that bovine tuberculosis, infectious abortion and hog cholera could also be controlled by assisting owners in the establishment and maintenance of disease-free herds. The assistance to be rendered would consist largely in preventing traffic in live-stock affected with or known to have been exposed to contagious or infectious disease. Such restrictions would, in addition to serving as a protection to the owners of disease-free herds, also serve as the greatest possible incentive to the owners of disease-infected herds to seek the aid of state and federal live-stock sanitary forces and make an earnest and honest effort to produce live-stock free from contagious or infectious diseases.

The following plan was presented to the Bureau of Animal Industry in 1907 and later announced to the live-stock breeders of Illinois. In the original plan a classification of "free herds" into "A," "B" and "C" classes was provided for. However, as every reputable cattle breeder aspires to own a ''state accredited'' herd without any qualifications of any kind; it seems desirable to eliminate the ''A,'' ''B'' and ''C'' classification.

To Pure Bred Cattle Breeders

IN THE

State of Illinois

To promote confidence in the healthfulness of cattle herds within the state and to fully meet the requirements of live-stock sanitary regulations which govern the shipment of cattle to various other states, from which such shipments are now practically barred; also to satisfy the minds of many prospective purchasers that high-class cattle of the various breeds can be safely purchased from the herds of many reputable breeders in Illinois, the State Board of Live Stock Commissioners of the State of Illinois is anxious to render to cattle owners and breeders within the state every possible assistance with the hope of reëstablishing Illinois at the head of the American cattle-breeding industry.

With this object in view the board has decided to officially recognize as being *free from tuberculosis* every herd of pure-bred cattle within the state coming within the provisions set forth in the form of an agreement between the owner and the State Board of Live Stock Commissioners, under which a fixed and authoritative standard of health can be permanently established and easily maintained, without depreciating in the slightest degree the actual value of any herd. On the other hand, under the operation of the proposed plan, all progressive cattle breeders within the state will be afforded an opportunity to realize an appreciation of at least twenty-five per cent over the present value of their herds.

In the event of pure-bred cattle owners being willing to adopt the proposed plan of official recognition and certification as to the health of their herds, the State Board of Live Stock Commissioners of the State of Illinois will endeavor to secure by coöperation with other State Live Stock Sanitary Boards, the privilege of an unrestricted movement of all such cattle throughout the United States. This would enable the owners of all officially recognized herds to sell and deliver cattle from such herds into many other states without the annoyance, needless expense and delay now occasioned by being required to subject all cattle intended for breeding or dairy purposes to the tuberculin test, immediately before making such sales and shipments.

BOARD OF LIVE STOCK COMMISSIONERS
STATE OF ILLINOIS

Application for Official Recognition by the State Board of Live Stock Commissioners of Herds of Pure-Bred Cattle Free from Tuberculosis

AGREEMENT

Section 1

In consideration of the assistance of the board in enabling me to establish and maintain my herd of cattle *free from tuberculosis,*

I, ...

Address ....

owner of....................................head of pure-bred

registered .... cattle,

none of which have been subjected to the tuberculin test within

................................days, do hereby agree as follows:

1. I will cause to be subjected to the tuberculin test, at my own expense, every animal in my herd exceeding the age of six months.
2. I will cause all cattle in my herd entitled to official recognition by the board to be annually subjected to the tuberculin test, or as often as may in the discretion of the board be considered necessary for the maintenance of such a herd.
3. I will cause all cattle which react to the tuberculin test and which show physical evidence of tuberculosis to be slaughtered within a reasonable time under the United States Meat Inspection Regulations.
4. I will cause all cattle which react to the tuberculin test, but which show no physical evidence of tuberculosis, either to be slaughtered and disposed of as herein provided, or I will cause all such animals to be removed from the herd and thereafter to remain segregated under quarantine to be established by the board.

5. I will add no cattle to said officially recognized herd which have not passed a tuberculin test administered by an authorized agent of the board within a period of thirty days and for which an official transfer has been issued.

6. I will cause infected premises to be thoroughly cleaned and disinfected as directed by the board.

7. In the event of my failure to fully comply at all times with any of the provisions embodied in this agreement, I hereby agree to forfeit all rights to claim official recognition of my herd of cattle by the State Board of Live Stock Commissioners.

Section 2

I hereby further agree that all cattle in my herd which may react to said official tuberculin test shall be placed in perpetual quarantine by said board and be handled therein as follows:

1. I will permit all cattle reacting to the official tuberculin test to be marked in such manner as to enable their identity to be permanently retained and I will not change the location of or slaughter any reacting cattle without permission of the board.

2. When segregated reacting bulls are used for breeding healthy cows I shall see that the cows bred to such bulls are not unduly exposed to infected premises or to other diseased cattle.

3. I will cause all calves from segregated reacting cows to be promptly and permanently removed from said infected premises at birth.

4. In all cases where the milk from segregated reacting cows is to be used for any purpose whatever, I will cause said milk to be pasteurized at a temperature of not less than 140 degrees F. for not less than twenty minutes.

5. I will add no cattle to said herd of reacting cattle without permission of the board and with the understanding that all cattle so added shall become a part of said herd until released by permission of the board.

6. In the event of my failure to fully comply at all times with any of the foregoing provisions embodied in this agreement, I hereby agree to forfeit all right to claim official recognition of my herd of cattle under Section 1 of this agreement.

7. It is hereby further agreed that the State Board of Live Stock Commissioners will, upon request of the owner of cattle reacting to the tuberculin test and placed in quarantine under this agreement, issue permits under which said cattle may be sold and delivered within the state under quarantine restrictions embodied herein.

IN WITNESS WHEREOF I have signed this, this............
day of..................................one thousand nine
hundred and...

....
Owner.

Witness:

....

Classification of Pure-Bred Cattle Herds Entitled to Official Recognition as Being Free from Tuberculosis

All cattle, including calves exceeding the age of six months in a herd eligible to official registration, shall be subjected to the tuberculin test, officially administered, in addition to which each animal must pass a thorough physical examination by a competent veterinarian. Each herd will be classified according to the result of the initial and each succeeding test, and designated as ''free herds.''

Free herds shall consist of cattle, all of which exceeding the age of six months must successfully pass the initial tuberculin test and physical examination, each of which shall be repeated annually. Example: 100 cattle tested; 100 cattle passed.

O. E. Dyson, State Veterinarian,
Springfield, Illinois.

The following proposed tuberculin test bill was drafted for the Illinois legislature with the following objects in view:

To promote the breeding of cattle free from tuberculosis by inducing owners to establish and maintain state accredited herds.

To prohibit competition on equal terms between owners of tuberculous cattle and the owners of clean herds.

To enable owners of infected herds to clean up their herds without compelling them to face enormous economic loss occasioned by the condemnation and slaughter of all cattle which may react to the tuberculin test.

To make it possible for the owner of an infected herd to realize the actual value of all cattle reacting to the test. This could be accomplished on the part of the state by compensating the owner to the amount of one-third of the appraised value of all cattle reacting to the test, and in addition thereto granting the owner the option of segregating such cattle and utilizing them for breeding or dairy purposes, under regulations which would render such action safe, practical and profitable.

To avoid the economic waste attending the slaughter of all reactors, which would constitute a burden too great for a large majority of the breeders or any cattle-breeding state to assume; furthermore, the supply of pure-bred cattle of both beef and dairy breeds would be depleted to such a degree by the slaughter of all reactors to the tuberculin test as to practically paralyze the industry.

To prohibit the sale of pure-bred cattle, except from tuberculin tested herds, and requiring the percentage of reactors removed from infected herds to be made a matter of public record, thereby establishing the actual value of a certificate of health issued to cover the sale of cattle from infected herds as compared with the value of a certificate of health issued to cover the sale of cattle from state accredited herds.

The compulsory tuberculin testing of cattle can never be made to serve a practical purpose. On the other hand, by restricting the sale of untested cattle, particularly pure-bred cattle, thereby protecting the interests of reputable breeders and dealers, it would be possible to render traffic in tuberculous cattle an unprofitable enterprise.

Up to this time practically no protection has been afforded to the owner of a clean herd against unfair competition; consequently, there has been but little incentive for breeders to establish and maintain state accredited herds, which is unquestionably the final solution of the problem.

The conservation of beef and dairy cattle herds can only be accomplished by guarding healthy herds against the ravages of a preventable disease, and providing for the growth and development of healthy herds from such cattle as now constitute a menace to the cattle-breeding industry. This can be accomplished only by the enactment and enforcement of laws necessarily required.

A BILL

For an Act to provide for the tuberculin testing of cattle herds consisting of bulls, cows or heifers upon the request of the owner thereof, and for the compensation of said owner for any bull, cow or heifer reacting to said tuberculin test.

SECTION 1. *Be it enacted by the People of the State of Illinois, represented in the General Assembly:* That any resident of the State of Illinois, desiring to have his entire herd, consisting of bulls, cows and heifers, subjected to the tuberculin test for the purpose of eradicating tuberculosis from the herd shall file with the State Veterinarian an application for the test, wherein said owner agrees to conform to the provisions embodied in said application, to-wit:

State Veterinarian,
Springfield, Illinois.

Sir:

I, ..., address ....
owner of .... head of cattle, none of which have been subjected to the tuberculin test to my knowledge within the past sixty (60) days, hereby request you to cause said cattle to be subjected to an official tuberculin test under the following terms, to-wit:

1. I will cause all said cattle which react to the tuberculin test but which show no physical evidence of tuberculosis, either to be

slaughtered and disposed of as herein provided, or I will cause the said animals to be segregated from other cattle and thereafter to remain segregated in quarantine.

2. I will cause all cattle, which react to the said tuberculin test and which show physical evidence of tuberculosis, to be slaughtered without delay under competent veterinary inspection, and will cause the carcasses of said cattle to be disposed of in accordance with the United States meat inspection regulations.

3. I hereby authorize you, or any veterinarian detailed by you, to administer the tuberculin test to said cattle, to brand all cattle reacting to the test with a hot iron in the form of a letter ''T'' in such a manner as to enable their identity to be permanently retained and I will not change the location of or slaughter any reacting cattle without permission.

4. I will cause all calves from segregated reacting dairy cows to be promptly and permanently removed from said infected premises at birth; otherwise they shall become a part of said quarantine herd. All beef breed calves which are permitted to run with segregated reacting dams shall be removed from the herd by the time they have reached the age of six months, and shall be maintained upon uninfected premises for a period of not less than three months, after which they shall be subjected to and must successfully pass an official tuberculin test; otherwise said calves shall become a part of said segregated herd.

5. In all cases where the milk from segregated reacting cows is to be used for any purpose whatever, I will cause said milk to be pasteurized at a temperature of not less than 150 degrees F. for not less than twenty minutes.

6. I will add no cattle to said herd of reacting cattle without permission and with the understanding that all cattle so added shall become a part of said herd.

7. It is hereby further agreed that the State Veterinarian upon request of the owner of cattle reacting to the tuberculin test and placed in quarantine under this agreement, will issue permits under which said cattle may be sold and delivered within the State under quarantine restrictions embodied herein.

IN WITNESS WHEREOF, I have signed this, this............ day of ...., One Thousand Nine Hundred and ....

....

Owner or Agent.

....

Witness.

Sec. 2. Upon receipt of said application properly executed by the owner of said bulls, cows or heifers it shall be the duty of the State Veterinarian to detail a competent assistant State Veterinarian to administer the tuberculin test to all bulls, cows or heifers comprising the herd of said owner. All expenses incurred in connection with the administration of said tuberculin test shall be borne by the State. All infected stables shall be promptly cleaned and disinfected by the owner under the direction of the State Veterinarian.

Sec. 3. All cattle reacting to the tuberculin test shall be branded with a hot iron with a brand in the form of a letter ''T'' and shall be held in quarantine upon the premises of the owner until officially released therefrom under the provisions of this Act. All cattle which successfully pass the tuberculin test shall be properly tagged with suitable ear-tags for identification.

Sec. 4. All cattle reacting to the tuberculin test which show physical evidence of disease shall be slaughtered without delay under State or Federal inspection.

Sec. 5. All cattle which react to the tuberculin test and which show no physical evidence of disease shall be placed in quarantine and at the option of the owner may be utilized for breeding or dairy purposes or said reacting cattle may be slaughtered in accordance with the provisions of this Act.

Sec. 6. All cattle reacting to the tuberculin test shall be appraised by an expert judge of the value of the various breeds and said appraiser shall report under oath to the State Veterinarian the value of said animals, together with a statement of the evidence of facts upon which said appraisement is based, and said State Veterinarian shall certify to one-third (⅓) of said appraised value of any bull, cow or heifer reacting to said tuberculin test to the Governor for his approval, and if the Governor shall find that said appraisement has been made in accordance with law, he shall approve the same for payment and the Auditor of Public Accounts shall upon presentation of same to him, thereupon issue his warrant upon the State Treasurer for the amount in favor of the owner of the animals covered thereby: *Provided,* that the appraised value of pure-bred registered cattle of either the beef or dairy breeds shall not exceed the sum of $300 per head and that the appraised value of grade cattle shall not exceed the sum of $100 per head. Certificates of registration and pedigree of all pure-bred cattle shall be furnished to the appraiser as an aid in arriving at the value of the cattle to be appraised.

Sec. 7. No compensation shall be paid to the owner of cattle which react to the tuberculin test, unless said cattle have been in said owner's possession not less than sixty days previous to the administration of the tuberculin test: *And, provided, further,* that no compensation shall be paid for cattle imported into the State within six months previous to date of test.

Sec. 8. If the owner of cattle reacting to the tuberculin test, administered as herein provided, shall elect to have said cattle slaughtered *in lieu* of holding said cattle in quarantine in accordance with the provisions of this Act, said owner shall receive as compensation the difference between the value of the carcass and offal of all bulls, cows or heifers passed upon post mortem inspection and the appraised value, provided said sum does not exceed one-third (⅓) of the appraised value thereof.

Sec. 9. On and after .... no pure-bred cattle, consisting of bulls, cows or heifers, shall be sold, offered for sale or delivered within the State except from State accredited herds or from herds wherein all cattle in the herd exceeding the age of six months shall have been subjected to a tuberculin test adminstered under the direction of the State Veterinarian within six months previous to the date of sale or delivery. All certificates of health shall be executed so as to plainly show the percentage of reactors in all herds infected with tuberculosis from which pure-bred cattle are sold or delivery is made.

In case of public auction sales the record of the herd from which pure-bred cattle are offered for sale shall be embodied in the sale catalogue in such a manner as to plainly show the percentage of reactors in all herds infected with tuberculosis. The record of the herd shall be publicly announced by the auctioneer at the time of offering said animals for bids or sale. The provisions of this Act shall also apply to cattle for exhibition purposes.

Any person, firm, corporation or company upon being convicted of violating any of the provisions of this act shall be fined in the sum of not less than $100.00 or more than $1,000.00.

An appropriation of not less than $250,000 per annum should be provided.

A BILL

For an Act to amend an Act entitled, ''An Act to revise the law in relation to the suppression and prevention of the spread of contagious and infectious diseases among domestic animals,'' approved June 14, 1909, in force July 1, 1909, as subsequently amended, by amending section thirteen (13) thereof.

SECTION 1. *Be it enacted by the People of the State of Illinois, represented in the General Assembly:* That an Act entitled, ''An Act to revise the law in relation to the suppression and prevention of the spread of contagious and infectious diseases among domestic animals,'' approved June 14, 1909, in force July 1, 1909, as subsequently amended, be and the same is hereby amended by amending section thirteen (13) thereof to read as follows:

Sec. 13. All bulls, cows or heifers exceeding the age of nine months brought into the State of Illinois by any person, persons, firm, company or corporation, or by any railroad or other transportation company (unless said bulls, cows or heifers are consigned to and delivered by the transportation company within the confines of the Union Stock Yards, Chicago, the National Stock Yards, St. Louis, East St. Louis, or the Union Stock Yards, Peoria), or any other like public stock yard, shall be accompanied by a certificate of health, including the tuberculin test, administered in accordance with the regulations of the United States Bureau of Animal Industry within thirty days previous to said cattle being brought into the State of Illinois.

The importation of pure-bred cattle consisting of bulls, cows or heifers shall be prohibited EXCEPT FROM STATE ACCREDITED HERDS, *or from herds wherein all cattle in the herd exceeding the age of six months shall have been subjected to the tuberculin test, administered under the direction of the live stock sanitary authorities of the state of origin, within six (6) months previous to the date of importation. All certificates of health, including the tuberculin test as herein provided, shall be executed in such a manner as to plainly show the percentage of reactors in all herds infected with tuberculosis from which the importation is made. In case of pure-bred bulls, cows or heifers being imported for the purpose of being disposed of at public sale the record of the herd from which said cattle have been removed shall be embodied in the sale catalogue in such a manner as to plainly show the percentage of reactors in all herds infected with tuberculosis, the announcement of which shall be made by the auctioneer at the time of offering said animals for* *bids or sale. All pure-bred cattle from infected herds shall be sold as having been exposed to the contagion of tuberculosis and shall be held in quarantine by the purchaser subject to the administration of an official tuberculin test at the expiration of ninety days from date of purchase.*

A BILL

For an Act to prevent the importation of diseased cattle and the spread of infectious abortion within the State.

SECTION 1. *Be it enacted by the People of the State of Illinois, represented in the General Assembly:* That on and after......... no cow or heifer shall be imported into the State for dairy or breeding purposes unless said cow or heifer is within four (4) weeks of completing a full period of gestation; or unless said cow has within a period of six (6) months given birth to a live and fully matured calf. There shall be no restrictions under this Act against the importation of unbred heifers under two years of age.

Sec. 2. All cows or heifers imported into the State (*in addition to being accompanied by a certificate of health, including the tuberculin test, as prescribed by law*) shall be certified to by the live stock sanitary officials of the State of origin as being eligible to entry under the foregoing provisions of this Act.

Sec. 3. No cow or heifer exceeding the age of two (2) years shall be sold or offered for sale at public auction within the State unless the herd from which said cow or heifer has been removed is free from infectious abortion or unless said cow has within six (6) months given birth to a live calf, fully matured; or unless said cow or heifer is within four (4) weeks of completing a full period of gestation. The foregoing provisions shall not apply to unbred heifers under two (2) years of age.

Sec. 4. Owners of cows or heifers offered for sale under section three (3) of this Act may certify to the freedom of such cattle from infectious abortion by executing an affidavit to the effect that the cattle offered for sale are from herds free from infectious abortion, or that said cows or heifers are otherwise eligible for sale under the provisions of this Act.

Sec. 5. Owners of cattle upon being convicted of falsely certifying to the freedom of cows or heifers from infectious abortion under the provisions of this Act shall be fined in the sum of not less than twenty-five (25) or more than one hundred (100) dollars.

INDEX

A

Accredited herd 101
Accredited herd plans....... 107

B

Bacillus tuberculosis 44
Bang method, modification of 72
Bang method of controlling tuberculosis 69
Barn, dairy and feed....... 45
Barn, sanitary 45, 46
Barn, inexpensive sanitary.. 100
Boards of health, municipal.. 18
Bureau of Animal Industry tuberculosis investigations. 73

C

Carcasses affected with tuberculosis, inspection of... 76
Carcasses fit for food....... 39
Cattle centers, tuberculous.. 24
Cattle, compulsory slaughter. 104
Cattle exposed to infection, sale of 104
Cattle for grazing, interstate shipment of 26
Cattle, grapes in.......... 33
Cattle, prevalence of tuberculosis among 14
Cattle retained for tuberculosis at packing plants.... 17
Cause of tuberculosis....... 44
Certificates of health....... 102
Cesari, E. 42
Chickens going light........ 33
Children, transmissibility of bovine tuberculosis to.... 34
Cholera, number of hogs retained at packing plants for 16
Conclusions regarding tuberculosis 74
Consumer's loss from tuberculosis 13
Consumption 33
Contagious abortion, eradication and control of....... 105
Control of hog cholera...... 105
Control of tuberculosis....66, 105
Control of tuberculosis by Bang's method 69
Control of tuberculosis by Ostertag's method 71
Control of tuberculosis by Pole's method 71
Curing of tuberculosis...... 47

D

Dairy and feed barn, type of. 45
Dairy barn, inexpensive and sanitary 100
Dairy barn, sanitary......45, 46
Delayed reactions 84
Diagnosis of tuberculosis.... 50
Disease producing organisms, difference in 41
Diseases, tuberculosis distinguished from other....... 44
Disinfection of site of injection 90
Dose of tuberculin.......... 90

E

Eradication of contagious abortion 105
Eradication of hog cholera... 105
Eradication of tuberculosis.. ....18, 66, 105

F

Federal meat inspection..... 9
Food, tuberculous carcasses fit for 39
Foot-and-mouth disease 105

G

Gilliland, Dr. 68
Grapes in cattle............ 33
Grazing cattle, interstate shipment of 26

H

Health, certificates of....... 102
Health, municipal boards of. 18
Herd, state accredited...... 101
Herefords, range herd of..... 95
History of tuberculosis...... 33
Hog cholera, eradication and control of 105
Hogs, prevalence of tuberculosis among 21
Hogs retained for cholera at packing plants 16
Hogs retained for tuberculosis at packing plants..... 16
Hutyra and Marek......... 63

I

Immunization of the young.. 68
Infection, modes of......... 49
Injection, disinfection of site. 90
Injection, how to make the.. 89
Injection, where to make the 88
Inspection of meat, federal.. 9
Inspection regulations for tuberculous carcasses 76
Interchange of tests........ 99
Interstate shipment of grazing cattle 26
Intradermal test 79
Intradermal test, accuracy of 93
Intradermal and ophthalmic tests, efficiency of........ 63
Intradermal and subcutaneous tests, comparison of.. 97
Intradermal test, extent of use of the.............. 86
Intradermal test, well defined reaction to 92
Investigations of tuberculosis by Bureau of Animal Industry 73

K

Koch, Prof. 33, 56
Krumwiede, Dr. 34

L

Legislation to control tuberculosis, proposed 111
Lesions of the pleura in tuberculosis 37
Loss from tuberculosis...... 7
Loss to the consumer from tuberculosis 13
Loss to the producer from tuberculosis 11
Lymphatic glands, tuberculosis of the............... 53

M

Meat inspection, federal..... 9
Meat inspection regulations.. 76
Meat, tuberculous 42
M'Fadyean, Prof............ 68
Melvin, A. D., Dr........... 14
Milk, spread of tuberculosis from 35
Milk, transmission of tuberculosis to children from.. 34
Municipal boards of health.. 18
Municipal ordinances for tuberculin testing 19

N

Needle, kind of............ 87
Nieberle, Dr. 43

O

Ophthalmic and intradermal tests, efficiency of........ 63
Ordinances for tuberculin testing, municipal......... 19
Ostertag's method of controlling tuberculosis 71

P

Packers pay less for tuberculous animals 12
Packing plants, number of cattle retained for tuberculosis at 17
Packing plants, number of hogs retained for cholera at 16
Packing plants, number of hogs retained for tuberculosis at 16
Park, Dr. 34
Pearson, Dr. 68
Peritoneum, tuberculosis of.. 54
Phthisis 33
Physical examination 50
Pleura, tuberculous lesions of. 37
Pole's method of controlling tuberculosis 71
Post-mortem findings in condemned animals 65
Prices reduced for tuberculous animals 12
Prevalence of tuberculosis among cattle and swine... 14
Prevalence of tuberculosis among hogs 21
Producer's loss from tuberculosis 11

R

Range cattle, tuberculosis among 15
Range herd of Herefords.... 95
Range herd of spayed heifers. 98
Reaction, how to observe.... 92
Reaction, type of........... 92
Reaction, when to observe... 91
Reactions, delayed 84
Regulations for inspection of tuberculous carcasses 76
Remedy to control tuberculosis 103
Remuneration for animals destroyed 23, 27

S

Sanitary dairy barn........45, 46
Sanitary dairy barn, inexpensive 100
Schweintz, Dr. 68
Sexual organs, tuberculosis of the 54
Shipment of grazing cattle, interstate 26
Slaughter of tuberculous animals 67
Slaughter of tuberculous cattle 104
Smith, Theobald 34
Spread of tuberculosis, contributory factors in...... 35
Spread of tuberculosis from milk 35
Spread of tuberculosis from traffic in cattle.......... 35
Spreaders 50
State accredited herd....... 101
State legislation to control tuberculosis, proposed.... 111
Statistics of tuberculin tests and post-mortem findings.. 65
Subcutaneous and intradermal tests, comparison of... 97
Suspects 81
Swine, prevalence of tuberculosis among 14
Symptoms of tuberculosis... 51
Syringe, kind of............ 87

T

Temperature measurements in the tuberculin test..... 61
Test, intradermal 79
Test, intradermal, accuracy of 93
Test, intradermal, extent of use of 86
Tests, convenience of....... 97
Tests, interchange of....... 99
Tests, ophthalmic and intradermal 63
Thermic tuberculin test, directions for 60
Transmissibility of bovine tuberculosis to children..... 34
Trudeau, E., Dr............ 68
Tuberculin, dose of......... 90
Tuberculin, kind of......... 87
Tuberculin test 56
Tuberculin test, skill in administering 82
Tuberculin test, temperature measurements in the..... 61
Tuberculin test, thermic..... 60
Tuberculin testing, municipal ordinances for 19
Tuberculin tests, statistics of 65

U

Udder, tuberculosis of the... 54

V

Villemin, Dr. 33
Von Behring, Dr........... 68

W

White plague 33
Wills, Dr. 84

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